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**Abstract**

Modern corporations use complex debt instruments and pursue acquisitions. In order to analyze the properties of some of these contracts in the event of an acquisition, this paper considers a company that has an incumbent capital structure, comprising one of five practically important structured debt contracts. An opportunity for an acquisition comes along that was not ex-ante contractible. The equityholder decides on the financing of this expansion by trading off tax advantages of debt against costs of bankruptcy. The model yields a number of insights for structured debt and acquisitions, four of which are as follows: First, a seniority clause offers the bondholder protection from agency, but it also decreases the equityholder's incentives to finance the acquisition. Second, embedded call options are valuable even if interest rates are constant, because they allow the equityholder to issue a new bond at fair value. Third, bankruptcy remoteness is valuable, if assets are very risky. Fourth, convertible bonds are vulnerable to agency and the conversion option bears the same incentive problem as a seniority clause. These properties explains, for example, the otherwise puzzling practice of companies buying out convertible bond holders prior to an acquisition.

**JEL Classification Numbers:** G24, G32, G34

**Keywords:** Capital structure, mergers and acquisitions, structured finance

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# 1 Introduction

Earlier literature about capital structure and investments, Modigliani and Miller (1958) for the financing side or McDonald and Siegel (1986) for the investment side, suggested that the investment decision may be disconnected from the financing decision as the Fisher Separation Theorem suggests. However, a number of papers like Gomes and Schmid (2010) have pointed out that in the presence of frictions, the investment decision and the financing decision of an individual firm, have to be evaluated jointly. It is already mentioned in the original Modigliani and Miller (1958) paper that: *These [ ... ] drastic simplifications have been necessary in order to come to grips with the problem. Having served their purpose they can now be relaxed in the direction of greater realism and relevance, a take which we hope others interested in this area will wish to share.*

In an insightful paper Leland (1998) laid the foundations for what is since known, as the *structural model for capital structure*. He analyzed the agency conflict between bondholders and equityholder over the operational as well as over the financial risk policy of a corporation. An interesting stream of literature on debt agency has evolved over time, analyzing financing and investment decisions jointly, usually under a capital structure that contains straight debt and equity. Mauer and Sarkar (2005) extended the theory toward financing real options and elaborated on the conflict of interests between the same pair of agents. Sundaresan and Wang (2008) on a theoretical level and Hennessy and Whited (2005) on an empirical level, added some insights about leverage ratios, implying lower leverage ratios for non-mature companies.

Most of the literature on financing real options address the question of the optimal capital structure and the value added or lost due to an acquisition only for the most basic form of debt - a straight bond. This stands in conflict with the large industry and volume of *structured debt contracts*. This market experienced a set back due to the late 2000s financial crisis. But in Q2 2010 emission volumes of structured debt contracts are - a least according to press reports - recovering.[1] A small number of papers have analyzed different forms of debt contracts, but mostly with respect to other issues than acquisitions and debt agency. Childs et al. (2005) showed that financial flexibility achieved by shorter debt maturity has an overwhelmingly positive effect on the agency conflict between the equityholder and the bondholder. In Leland (1998), the same thing was found to be inefficient. Hackbarth et al. (2008) analyze the consequences of using bank debt as opposed to public debt on leverage ratios and the choice of seniority. Martellini

[1] See e.g. "Bank of America Said to Market 300 Million CLO for Tetragon", by Pierre Paulden, Bloomberg, Jul 19, 2010 or in general on the subject "Bringing back CLOs", by Vipal Monga, The Deal Magazine, November 27, 2009.

and Milhau (2009) look at the choice of fixed vs. floating rate debt, but within an asset and liability management perspective. Hennessy and Tserlukevich (2008) consider convertible and callable bonds within a Leland (1998)-model. This is however a model of risk switching instead of investmenting and there are no unexpected actions.
In a second insightful paper, Leland (2007) analyzes the financial synergies that asset securitization may provide. He starts with the observation, that issuer of asset backed securities use rather abstract terms when explaining the value added of securitization, such as the claim that it *unlocks hidden asset value.* The paper analyzes how financial benefits of a merger depend upon asset volatility as well as on the correlation between incumbent assets and new assets. In that paper however, there are no diverging interests between the bondholders and the equityholder and thus no room for agency conflicts.
In the present paper, I analyze the value added, potential agency gains/losses and potential welfare loss associated with five distinct structured debt contracts in the event of an unexpected corporate acquisition. In a two-period trade off model of capital structure, this paper sets to answer the following questions:

1. How do bondholders and equityholders gain or loose on grounds of an unexpected acquisition given an incumbent structured debt contract? Who is it that incurs losses or realizes gains?

2. How is the direction as well as the order of magnitude of these value shift influenced by risk, bankruptcy costs and taxes?

3. What part of these gains or losses are associated to agency?

4. How relevant is a potential welfare loss caused by agency?

5. What kind of elements of financial structuring protect from agency costs, what elements favor agency costs?

6. What is a good debt contract if unexpected acquisitions are potentially an issue.

The setup in this paper in some sense includes an incomplete contract on restructuring, since it is assumed that further capital structure adjustments are not contractible ex ante. Any kind of gains/losses associated with agency in this paper are the result of limited contractibility. The two period model I consider, is an extension of the model in Leland (2007). There exists one company that has an incumbent capital structure and incumbent assets. These assets are normally distributed. A merger or an acquisition becomes available to the company, that requires

fresh capital if it is pursued. This comes as a surprise for all stakeholders, which is different to sequential financing, where the future investment needs are known ex ante. So it is a situation of imperfect rather than asymmetric information, what makes the situation a problem of incomplete contracting. All the bargaining power in this paper is assumed to be in the hands of the equityholders.
The incumbent capital structure in the setup in this paper contains equity and a debt contract, which can be

- I) an unsecured straight bond without priority
- II) a senior secured straight bond
- III) a callable bond
- IV) a single asset and single tranche collateralized loan obligation (CLO)
- V) a convertible bond

A word on the meaning of the term *structured finance* at this point. There are commonly two meanings associated with this term. First, structured finance in a narrow sense means the kind of contracts that boomed prior to the late 2000s financial crisis, which were termed collateralized loan obligation (CLO). One of the main feature of that kind of debt contract is that it is secured with specific asset(s) which are transferred to a bankruptcy remote special purpose entity. So in its narrow meaning, structured finance is equivalent to asset securitization or project financing. In the narrow sense of the word only contract (IV) - which is a single asset and single tranche CLO - is a structured debt contract. This is the way the term is used in Leland (2007). Second, in a broader sense the term structured finance means all kind of debt contracts that have more complex contractual clauses than a simple straight bond. This is how the word is used in Vanden (2009) or in Jobst (2007). That is also the way the term *structured* is used in connection with structured products that are sold to investors in wealth management. Therefore in its broad meaning contracts (II) - (V) are structured debt contracts. I will use the term in its broad meaning and consider its narrow meaning as a specific form of structured finance, namely asset securitization.
The capital for the acquisition is raised by an optimal package of equity and straight debt only. This has two reasons: First, the conflict of interests arises between the incumbent bondholder and the equityholder, so the incumbent debt contract is the object of interest not the new debt contract. The new bondholders receive a fairly priced bond independent of what kind of debt

contract they buy, anything else would be arbitrage. Second, it limits the number of situations considerably. The decision of the capital structure is taken either to maximize the company's total value or to maximize the value of the company's equity stake. The objective function is a trade off, optimizing between the tax advantage of debt and the costs of bankruptcy, as first formalized by Kraus and Litzenberger (1973). *Value added* is the value added or lost that the incumbent bondholders and the equityholder realize from the acquisition. *Agency costs/gains* are a subset of value added, that is realized as a direct consequence of implementing an equity maximizing rather than a value maximizing capital structure i.e. agency costs are a transfer in value from the bondholder to the equityholder. There may also be a welfare loss or deadweight loss, which is the loss in overall value on implementing an equity maximizing capital structure rather than a value maximizing capital structure. Similar to Leland (2007), it is assumed that assets are additive i.e. that there are no operational synergies associated with acquisitions. A value increase/loss of one stakeholder is therefore either an overall value added provided by the acquisition or a transfer of value from one stakeholder to the other.

There are four issues that drive value added: the volatility of the acquired assets, the tax shield, the bankruptcy costs and limited liability. An acquisition may increase or decrease the former three, depending on the specifics of the incumbent debt contract, the incumbent assets and the new assets. The effect of limited liability is always value decreasing as it has been noted by Sarig (1985) and others.

There are two distinct forms of agency occurring in this model: Through controlling the acquisition the equityholder may influence the overall volatility of the company's assets. From the bondholders perspective the equityholder may engage in what was termed *asset substitution* in Jensen and Meckling (1976). This term means a transfer of value from the incumbent bondholder's claim to the equityholder's claim through a worsening of the quality of the company's assets. This also works indirectly: The equityholder may take on excess leverage that is pari passu to the incumbent bond in order to dilute the incumbent claim. This is termed *debt dilution.*[2]

The second agency problem is an underinvestment problem of the equityholder. Originally, it was termed *debt overhang* by Myers (1977). It is the problem that some of the additional capital that the equityholder invests or more precisely some of the profits that this additional capital yields, is ex post claimed by the bondholders. The bondholder free rides on the equityholder's additional capital outlay.

[2]See e.g. Schwartz (1989).

Question 2 at the beginning refers to three parameters of interest, risk, bankruptcy costs and the tax rate. I will offer on each of the three parameters a perspective to analyze the effects of an unexpected acquisition on the structured debt contracts. With the term *perspective* I refer to an appropriate two dimensional grid over which a mesh of e.g. added value for the equityholder is drawn. A perspective is therefore a three-dimensional representation of value added, agency costs, etc. This allows to see how the value of the contracts evolves over an extensive set of values for the key parameters risk, bankruptcy costs and the tax rate. Whenever possible, the numerical findings are affirmed with anecdotal evidence from the financial market.

By analyzing these three perspectives, it is shown that unsecured straight debt is vulnerable to agency - more precisely claim dilution - unless risk is low and the tax rate is high. In terms of bankruptcy costs, agency costs are the worst when bankruptcy costs are at an average level.

A seniority clause helps to protect the bondholder from this form of agency, but it gives raise to the other agency problem that is similar to debt overhang. As a consequence of the seniority clause, the bondholder profits form the equityholder's investment without contributing to it. The equityholder's value added from an acquisition is then reduced or even negative.

An embedded call option can help to overcome this latter agency problem, since it allows the equityholder to refinance an incumbent bond. The incumbent bond, whose value potentially increases after the acquisition, may then be replaced with one whose price is exactly at fair value after the acquisition.

Securitization offers another way to overcome the second agency problem but with a different tool, namely bankruptcy remoteness. The assets are kept separately from each other such that there is no issue with debt overhang. Moreover, bankruptcy remoteness can reduce financing costs if the acquisition is very risky, because if one asset is in distress it cannot infect the other. The equityholder can, similar to Leland (2007), further profit from additional limited liability that is provided by the additional entity.

A convertible bond - often praised as sweetened debt - is problematic: In Green (1984) it was argued that convertible bonds are a solution for asset substitution. However, similar as in Hennessy and Tserlukevich (2008), the agency problem that occurs and the equityholder's incentives depend on whether the bond part or the option part of the convertible bond dominates. When it is the bond part that dominates, the convertible bond is - similar to an unsecured bond - vulnerable to claim dilution. When it is the conversion option that dominates, the equityholder has a constant debt overhang problem, similar to a seniority clause. This is because the conversion option allows the bondholder to profit form the equityholder's additional capital outlay

to finance the acquisition - without contributing to it. A conversion option potentially prevents asset substitution as proposed by Green (1984), but it exchanges it with a debt overhang problem. For that reason, a convertible bond ought to be issued callable and should be called prior to acquisitions. Vanden (2009) proposes an altered payoff structure for a convertible bond that adjusts itself to the value of the assets. However, that payoff structure bears large bankruptcy costs and it is at least questionable whether it would be qualified as debt for tax and bankruptcy purposes.

The conclusion is that - within the scope of this model - a callable bond with a seniority clause is the optimal choice for a company that potentially has to deal with unexpected acquisitions. It offers protection against both forms of agency and allows to redeem the bond when an acquisition is carried out. Securitization is the optimal choice if the risk of the acquisition is very high. Then bankruptcy remoteness becomes valuable.

The remainder of the paper is organized as follows. Section 2 introduces the model. Section 3 delivers the results and predictions of the model and relates it to anecdotal evidence. Section 4 offers recommendation for debt structuring. Section 5 concludes.

# 2 The model

The model I present in the paper to analyze debt structuring and acquisitions is a two period trade off model of capital structure. It is essentially an extension of the model in Leland (2007). What makes the model in this paper different from the model in Leland (2007) is that i) structured debt contracts are analyze and ii) more than one debt contract may be on the company's books. Without the later one does not have an agency conflict, which is the case in Leland (2007) and which is what is intended by the respective paper, since the questions addressed in that paper are different form the questions addressed in the present paper. In this part, the model is introduced.

## A. The basic model - A corporation with one asset and one straight bond on it's books

### I) Corporate tax law and corporation law

Two common characteristics of corporate tax law and corporation law are part of this model: i) A corporation's operational activities are subject to corporate taxation, the tax rate is denoted by $\tau$, ii) interest payments on corporate debt are tax deductible and iii) a corporation enjoys

limited liability.[3] A corporation in this model is therefore similar to the payoff of a call option written on the company's assets with strike price zero. As already mention in Leland (2007), there is a cross dependency here: The value of the debt influences the interest expenditures, the interest expenditures influence the value of the tax shield and the tax shield influences company's asset value. But the company's asset value in turn influence the value of the debt.

### II) Assets and environment

The model is a two period model, so there are only two points in time relevant to the model, namely $t = 0$ and $t = T$, where $T$ is some point in the future. An asset in this model is denoted by $X_i^t$, where $i$ denotes the index and $t$ the time. Assets are a future cash flows generated at $t = T$ by some business activity. Assets are assumed to be normally distributed, with some mean $\mu_i \in (0, \infty)$ and some standard deviation $\sigma_i \in (0, \infty)$ i.e. an asset is fully defined by the pair $(\mu_i, \sigma_i)$.[4] If a company owns two assets, these two assets have some correlation $\rho_{i,j} \in [-1, 1]$. There are no operational synergies in this model i.e. payoffs are additive. There exists a risk free asset or a risk free interest rate $r_f$. Also, universal risk-neutrality is assumed. This immediately implies that at $t = 0$, asset $i$'s value needs to be equal to

$$X_i^0 = \mathbb{E}\left[\frac{X_i^T}{\left(1 + r_f\right)^T}\right]$$

i.e. the discounted expected value.

### III) A straight bond in this model

A straight bond in this model is a financial security, that promises to pay an amount or principal $P$ at maturity. At $t = 0$ the corporation issues such a security at fair market value $D(P)$. The difference between $P$ and $D(P)$ is the interest paid on this debt contract. Since interest payments are tax deductible, the company is - given it has a straight bond on it's books - only subject to taxation if the company's earnings are higher than it's interest expenses i.e. if

$$X_i^T > X_{ZT} = P - D(P) \tag{1}$$

[3] Especially the second feature of corporation law is - according to Kraakman et al. (2009) - a fundamental principle of corporation law. As such it is found in next to every developed jurisdiction.

[4] *Financial* assets are commonly assumed to have a support greater than zero. However, real assets may have a value less then zero. One may think of an activity that causes huge claims for compensation for damage.

where $X_{ZT}$ denotes a zero tax boundary.

A company files for bankruptcy if the value of it's assets at $t = T$ are below $P$. Since it is a two period model, a default leads to a liquidation in the spirit of Chapter 7[5] or Title 6 of the Swiss Bankruptcy Code[6]. Together with the deductibility of interest paid on the bond, this implies that the default boundary $X_d$ in this model satisfies

$$X_d = P + \tau \max(X_i^T - X_{ZT}, 0)$$

One needs to have $X_d \geq X_{ZT}$, otherwise the interest payment would exceed the final fixed payment which is a contradiction.[7] A company therefore defaults in this model if

$$X_i^T < X_d = P + \frac{\tau}{1-\tau} D(P) \tag{2}$$

Default is assumed to be costly, if a company defaults some fraction $\alpha$ of asset value is lost. Given corporate taxation and costly default, an optimal capital structure can be derived that is the solution to the trade off first formalized in the Kraus and Litzenberger (1973), where the tax shield is traded off against bankruptcy costs.

The question arises, how interest payments have to be treated, when a company is in default. In Leland (2007) it is assumed that the company - and thus it's bondholders - retain full interest deduction in default. Kim (1978) argues, based on a legal assessment, that creditors of a bankrupt corporation will most likely loose the tax shield. I will follow Kim (1978) and assume that bankrupt corporation loose their tax shield.[8]

Given the real and legal environment in this model, the fair market value $D(P)$ of a straight bond with principal $P$ on the books of company with one asset is

$$D(P) = \frac{1}{(1+r_f)} \left( P \left( 1 - \Phi \left( \frac{X_d - \mu_i}{\sigma_i} \right) \right) + (1 - \alpha - \tau) G(0, X_d, \mu_i, \sigma_i) \right) \tag{3}$$

and the market value of the equity $E$ is

[5] 11 United States Code (2010), Chapter 7.

[6] Bundesgesetzt über Schuldbetreibung- und Konkurs (SchKG), SR 281.1.

[7] This is shown in Leland (2007), page 771.

[8] Under Swiss Law, namely under §149(4) of the Swiss Bankruptcy Code, post petition interest is not tax deductible. Under the United States Bankruptcy Code (11 United States Code (2010)) it is less clear: The wording of §502(b)(2) of the United States Bankruptcy Code implies the same regime as under Swiss law. The case law on this matter is opaque. As note in Potter (2002), there seems to be a conflict between state level courts and the Circuit Courts. In the case of *In re Continental Vending Mach. Corp.* (77-1 U.S.T.C., 9121 (E.D.N.Y. 1976)) as well as in *Kellogg v. United States (In re West Texas Marketing Corp.*, 54 F.3d 1194.) the second and the fifth circuit court have denied deduction of post petition interest to bankrupt corporations. In the case *In re Dow Corning Corp.* (270 B.R. 393.) the Eastern District of Michigan Bankruptcy Court has granted deduction of post petition interest.

$$E(P) = \frac{1}{(1+r_f)^T}\left(G(X_d,\infty,\mu_i,\sigma_i) - P\left(1-\Phi\left(\frac{X_d-\mu_i}{\sigma_i}\right)\right)\right) -$$
$$\frac{\tau}{(1+r_f)^T}\left(G(X_d,X_{ZT},\mu_i,\sigma_i) - X_{ZT}\left(1-\Phi\left(\frac{X_d-\mu_i}{\sigma_i}\right)\right)\right) \quad (4)$$

where

$$\phi(x) = \frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}x^2\right);\ \Phi(x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x}\exp\left(-\frac{1}{2}y^2\right)dy = \frac{1}{2}\left(1+erf\left(\frac{x}{\sqrt{2}}\right)\right)$$

$$G(x_d,x_u,\mu,\sigma) = \int_{x_d}^{x_u}\frac{x}{\sigma}\phi\left(\frac{x-\mu}{\sigma}\right)dx = \mu\left(\Phi\left(\frac{x_u-\mu}{\sigma}\right)-\Phi\left(\frac{x_d-\mu}{\sigma}\right)\right)+\sigma\left(\phi\left(\frac{x_d-\mu}{\sigma}\right)-\phi\left(\frac{x_u-\mu}{\sigma}\right)\right)$$

### IV) Optimal capital structure

The optimal capital structure is determined by selecting the optimal principal $P^*$. Since there is in case with only one bond in place no room for agency problems, an equity maximizing strategy is equivalent to an value maximizing strategy. The optimal principal is determined by solving the problem

$$P^* = \arg\max_P \{D(P) + E(P)\} \quad (5)$$

Since the legal setup for the company's tax treatment creates the mention cross dependencies and the equations determining $D$ and $E$ contain special functions, it is not possible to solve the above problem explicitly. One has to rely on numerical techniques in order to obtain $P^*$.

## B. Acquisitions and structured debt contracts in this model

### I) Acquisitions and their implementation

In this section I introduce acquisitions and structured debt contracts. At $t = 0$ it is assumed that the company has already an asset 1 defined by the pair $(\mu_1, \sigma_1)$ on it's asset side of the balance sheet. On the liability side it has a debt contract with principal $P_1^*$ and equity. It's capital structure is optimally selected according to the objective function in equation 5.

At $t = 0$, an acquisition becomes available - i.e. the company may invest in a second asset, which is defined by the pair $(\mu_2, \sigma_2)$ and correlation $\rho_{1,2}$. The new investment opportunity set is therefore defined by the five parameters $(\mu_1, \sigma_1, \mu_2, \sigma_2, \rho_{1,2})$. Assets are traded at their unlevered after tax value. The company may finance the acquisition by a mix of straight debt and equity i.e. the company may issue a second bond with principal $P_2$. The optimal principal $P_2$ of the

new bond depends on the incumbent contract as well as on the objective function which may either be value maximizing or equity maximizing.

### II) Debt contracts in the extended model

In the following I introduce the debt contracts listed in the introduction. I will define the contracts and give pricing formulas for the market value of the structured debt contracts after the acquisition, the new straight debt contract and the equity. These equations are the extended versions of equations 3 and 4. It was assumed that assets are additive and normally distributed. As a consequence of this, for contracts which do not require that the company places the assets in bankruptcy remote entities, the asset side of the company may be treated as one synthetic asset 3, which is described by the parameter pair $(\mu_3, \sigma_3)$, where $\mu_3 = \mu_1 + \mu_2$ and $\sigma_3 = \sqrt{\sigma_1^2 + \sigma_2^2 + 2\sigma_1\sigma_2\rho_{1,2}}$.

*i) Unsecured straight bond*

In this model, an unsecured straight bond is a bond with principal $P_1$, which is not specifically secured with the asset side of the company. This means that the bondholder's claim has no priority over other debt claims when the liquidation proceeds are distributed. This is the first of the so called *priority principles* of Schwartz (1989) that the current United States Bankruptcy Code as well as the Swiss Bankruptcy Code follow. This principle essentially means that the incumbent bond and the new bond are pari passu when liquidation proceeds are distributed. The zero tax barrier is at

$$X_{ZT} = P_1^* - D_1(P_2) + P_2 - D_2(P_2) \tag{6}$$

and the default barrier at

$$X_d = P_1^* + P_2 + \frac{\tau}{1-\tau}(D_1(P_2) + D_2(P_2)) \tag{7}$$

Then the market value of the incumbent and the new debt contracts are

$$D_1(P_2) = \frac{1}{(1+r_f)}\left(P_1^*\left(1 - \Phi\left(\frac{X_d - \mu_3}{\sigma_3}\right)\right) + \frac{P_1^*(1-\alpha-\tau)}{P_1^* + P_2}G(0, X_d, \mu_3, \sigma_3)\right) \tag{8}$$

and

$$D_2(P_2) = \frac{1}{(1+r_f)}\left(P_2\left(1 - \Phi\left(\frac{X_d - \mu_3}{\sigma_3}\right)\right) + \frac{P_2(1-\alpha-\tau)}{P_1^* + P_2}G(0, X_d, \mu_3, \sigma_3)\right) \tag{9}$$

The first term is just the repayment of the principal in case the company does not default. In default, which is the second term, the bondholders are pari passu, i.e. from the liquidation proceeds they both receive a share that is proportional to the ratio of their own principal over total outstanding liabilities. The market value of the equity is then

$$E(P_2) = \frac{1}{(1+r_f)}\left((1-\tau)G(X_d,\infty,\mu_3,\sigma_3) - (P_1+P_2-X_{ZT})\left(1-\Phi\left(\frac{X_d-\mu_3}{\sigma_3}\right)\right)\right) \tag{10}$$

The equation for the equity has only a non-default term. It receives all proceeds form the assets minus the debt payments plus the tax shield if the company is solvent.

*ii) Senior secured straight bond*

In this model, a senior secured bond is a bond with principal $P_1$ that is secured with the company's assets. It has priority over a potential new bond issued by the company, meaning when liquidation proceeds are distributed, this bond is served first. This is the third principle of the priority principles in Schwartz (1989). The new junior bond only receives liquidation proceeds if the senior bond is fully served. As a consequence of that clause, one needs an additional barrier that indicates - given the company has defaulted - at what level the senior bond is fully served and thus the junior bond receives liquidation proceeds. One may view this as a synthetic default barrier for the incumbent senior bond, since every state above this barrier yields a payoff for that bond that is equivalent to a state above the default barrier. This barrier $X_{SD}$ is at[9]

$$X_{SD} = \frac{P_1^*}{1-\tau-\alpha}$$

The distribution of liquidation proceeds is the only difference between i) and ii). This implies that the equations for the default barrier, the zero tax barrier and the fair market value of the equity remain the same i.e. equations 6, 7 and 10 remain valid for this contract. The fair market value of the incumbent senior bond after the acquisition is

$$D_1(P_2) = \frac{1}{(1+r_f)}\left(P_1^*\left(1-\Phi\left(\frac{X_{SD}-\mu_3}{\sigma_3}\right)\right) + (1-\alpha-\tau)G(0,X_{SD},\mu_3,\sigma_3)\right) \tag{11}$$

[9]For more convenient pricing equation, one would like to have the following ordering between the new synthetic default barrier and the real default barrier: $X_{SD} \leq X_d$. Given the form of the default barrier, this is satisfied by the condition $\frac{\alpha}{1-\alpha-\tau}P_1^* \leq P_2 + \frac{\tau}{1-\tau}(D_1+D_2)$ - which essentially means, that $\alpha$ should not be too large. If $\alpha$ would be very large then the gap between the company as a going concern and the company in liquidation could be large enough that there exists a state where the company as a going concern has enough proceeds from the assets to pay off both bonds, but in liquidation not enough to serve the senior bond. From here on forward I will assume, that $\alpha$ is small enough that such a state does not exists.

which looks like a conventional bond whose default barrier is at the synthetic default barrier. The fair market value of the new junior bond is

$$D_2(P_2) = \frac{1}{(1+r_f)}\left(P_2\left(1-\Phi\left(\frac{X_d-\mu_3}{\sigma_3}\right)\right)+(1-\alpha-\tau)G(X_{SD},X_d,\mu_3,\sigma_3)\right)-$$

$$\frac{1}{(1+r_f)}\left(P_1^*\left(\Phi\left(\frac{X_d-\mu_3}{\sigma_3}\right)-\Phi\left(\frac{X_{SD}-\mu_3}{\sigma_3}\right)\right)\right) \tag{12}$$

The first term is the value given the company does not default and the second and third term are *leftovers* from the liquidation proceeds that the junior bond receives in default.

*iii) Callable bond*

A callable bond in this model is an incumbent bond with principal $P_1$, that the company may call at time $t = 0$ at pre-acquisition fair market value[10]. The callable bond allows the company to have, a *restart* or *reset* of it's capital structure i.e. it may call the bond prior to the acquisition and refinance it together with the acquisition bond. What kind of impact that has on the value of the equity, I will discuss in the next section. As far as the pricing equations are concerned, it is essentially the same as in the base case, only that the asset side of the balance sheet is now larger and contains the synthetic asset 3, so equations 3 and 4 govern the fair market values for the scenario where a callable bond has been redeemed.

*iv) CLO*

A CLO is a bond with principal $P_1$ that is secured with a specific asset of the issuing company. To protect this asset from a potential default of the issuer on a combined level, the company places the asset in a bankruptcy remote entity or simply in a subsidiary[11]. The company then levers the asset through this subsidiary. The result is a debt contract that is backed by a specific bankruptcy remote asset. After the acquisition there are two CLOs, one backed with asset 1, the other backed with asset 2. As a consequence of that, the fair market value of the debt contracts after the acquisitions as well as of the equity stakes may be valued with equations 3 and 4.

*v) Convertible bond*

A convertible bond is a bond that combines an unsecured straight bond with an option on

[10] Usually, calling a bond involves paying a penalty fee, but within the scope of this model, such a penalty fee would be arbitrage.

[11] Strictly spoken, just placing assets in a subsidiary does not make them a priori bankruptcy remote. Paragraphs $35-45$ of FAS 140 detail the conditions that have to be (jointly) fulfilled by a subsidiary to qualify for the status of a *qualifying special purpose entity*. This status is necessary to issue CLOs. The nature of the technicalities in FAS 140 are important but beyond the scope of this paper. It will just be assumed that they are fulfilled.

some of the company's equity. In this model, it is a bond with principal $P_1$ and the option to convert it into a fraction $\lambda$ of the company's equity. If $\lambda$ - the conversion ratio - is equal to zero, the conversion feature is void and the bond is equivalent to an unsecured straight bond. The convertible bond is - as a result of the conversion privilege - assumed to be junior to a potential new bond i.e. it contains a subordination clause. The conversion option is assumed to be dilution protected. Also - given the conversion option is exercised - the hypothetical tax shield provided by the convertible bond before it is converted is lost.

Sofar, all the different debt contract had the same pricing equations prior to the acquisition, when the company has only one asset and one incumbent bond on its books. They were presented in equations 3 and 4. Because of the conversion option, the convertible bond does not share these equations. The default bound and the zero tax bound as per equations 1 and 2 remain the same. The bondholder naturally exercises the conversion option optimally i.e. one has to define a conversion bound. This bound is at the point, where the value of the company's assets is high enough to make the hypothetical equity stake of the bondholder worth more than the principal received when the bond matures[12]

$$X_{CV} = \frac{P_1}{(1-\tau)\lambda}$$

The fair market value of a convertible bond prior to the acquisition is then

$$D(P_1) = \frac{1}{(1+r_f)^T}\left((1-\tau)\lambda G(X_{cv}, \infty, \mu_1, \sigma_1)\right) +$$

$$\frac{1}{(1+r_f)^T}\left(P_1\left(\Phi\left(\frac{X_{CV}-\mu_1}{\sigma_1}\right) - \Phi\left(\frac{X_d-\mu_1}{\sigma_1}\right)\right) + (1-\alpha)G(0, X_d, \mu_1, \sigma_1)\right) \tag{13}$$

where the first term is the value if the bond is converted, the second term the value when the bond is not converted and the third term the value when the company defaults. The fair market value of the equity stake is

$$E(P_1) = \frac{1}{(1+r_f)^T}\left((1-\tau)(1-\lambda)G(X_{cv}, \infty, \mu_1, \sigma_1)\right) +$$

$$\frac{1}{(1+r_f)^T}\left((1-\tau)G(X_d, X_{cv}, \mu_1, \sigma_1) + (\tau X_z - P_1)\left(\Phi\left(\frac{X_{CV}-\mu_1}{\sigma_1}\right) - \left(\frac{X_d-\mu_1}{\sigma_1}\right)\right)\right) \tag{14}$$

[12] A problem of ordering similar to the one in footnote 9 arises here: One of course wants an ordering $X_d < X_{CV}$. For that purpose the condition $\frac{P_1}{X_d} > \lambda$ should be satisfied i.e. the conversion ration should not be to high. From here on forward I will assume that this is the case.

That is the situation prior to the acquisition. Again the company finances the unexpected acquisition with a mix of debt and equity. As already mention, it is assumed that the bond part of the incumbent convertible bond is junior to the acquisition bond. The principal of the incumbent convertible bond is optimally determined given the pre acquisition assets of the company using equation 5. $P_2$ denotes again the principal of the acquisition bond.
As a consequence of the combination of an incumbent convertible bond and a new bond, a number of bounds are needed. These are presented in the list below

- A conversion bound $X_{CV} = \frac{P_1^* + P_2\lambda - \lambda\tau(P_2 - D_2(P_2))}{\lambda(1-\tau)}$
- A zero tax bound when the conversion option has been exercised $X_{ZT_2} = P_2 - D_2(P_2)$
- A zero tax bound when the conversion option has not been exercised $X_{ZT_1} = P_1^* - D_1(P_2) + P_2 - D_2(P_2)$
- A default bound $X_d = P_1^* + P_2 + \frac{\tau}{1+\tau}\left(D_1(P_2) + D_2(P_2)\right)$
- A synthetic default bound for the acquisition bond[13] $X_{SD} = \frac{P_2}{1-\alpha-\tau}$

The fair market value of the incumbent convertible bond is then

$$D_1(P_2) = \frac{1}{(1+r_f)^T}\left(\lambda(1-\tau)G(X_{CV},\infty,\mu_3,\sigma_3) - \lambda P_2\left(1-\Phi\left(\frac{X_{CV}-\mu_3}{\sigma_3}\right)\right)\right) +$$

$$\frac{1}{(1+r_f)^T}\left(\lambda\tau X_{ZT_2}\left(1-\Phi\left(\frac{X_{CV}-\mu_3}{\sigma_3}\right)\right) + P_1^*\left(\Phi\left(\frac{X_{CV}-\mu_3}{\sigma_3}\right) - \Phi\left(\frac{X_d-\mu_3}{\sigma_3}\right)\right)\right)$$

$$\frac{1}{(1+r_f)^T}\left((1-\alpha-\tau)G(X_{SD},X_d,\mu_3,\sigma_3) - P_2\left(\Phi\left(\frac{X_d-\mu_3}{\sigma_3}\right) - \Phi\left(\frac{X_{SD}-\mu_3}{\sigma_3}\right)\right)\right) \tag{15}$$

The first three terms reflect the situation when bond is converted, the fourth term the situation when the bond is not converted and the fifth and sixth term the situation when the company defaults. The fair market value of the new bond is

$$D_2(P_2) = \frac{1}{(1+r_f)^T}\left(P_2\left(1-\Phi\left(\frac{X_{SD}-\mu_3}{\sigma_3}\right)\right) + (1-\alpha-\tau)G(0,X_{st},\mu_3,\sigma_3)\right) \tag{16}$$

[13]This bound is necessary because it is assumed that the new bond is senior to the convertible bond.

The fair market value of the equity stake after the acquisition is

$$E(P_2) = \frac{1}{(1+r_f)^T}\left((1-\lambda)\left((1-\tau)G(X_{CV},\infty,\mu_3,\sigma_3) - (P_1 - \tau X_{ZT_2})\left(1-\Phi\left(\frac{X_{CV}-\mu_3}{\sigma_3}\right)\right)\right)\right) +$$

$$\frac{1}{(1+r_f)^T}\left((1-\tau)G(X_d,X_{CV},\mu_3,\sigma_3) - \left(P_1^* + P_2 - \tau X_{ZT_1}\right)\left(\Phi\left(\frac{X_{CV}-\mu_3}{\sigma_3}\right) - \Phi\left(\frac{X_d-\mu_3}{\sigma_3}\right)\right)\right) \tag{17}$$

**III) The optimal financing of the acquisition**

The capital structure to implement the acquisition may either maximize the company's total value or only maximize the company's equity value. Prior to the acquisition with only one bond, these two strategies are equivalent - anything else would be arbitrage. With an acquisition after the incumbent bond has been issued, these two strategies are not necessarily equivalent. The reasons for that is that the acquisition allows the equityholder to alter the capital structure subsequentially to his advantage. I will address this in more detail in section 3. Equation 18 - which is the two bond equivalent to equation 5 - states the problem to obtain the optimal principal $P_2^*$ for a *value maximizing* post acquisition capital structure.

$$P_2^* = \arg\max_{P_2}\{D_1(P_2) + D_2(P_2) + E(P_2)\} \tag{18}$$

The objective function for the *equity maximizing* capital structure is to maximize the equity's net advantage of the acquisition i.e. the equityholder's value added minus the equityholder's capital outlay to the financing of the acquisition which is denoted by $e(P_2)$. The capital outlay is the fraction of the costs[14] of the acquisition $K = \frac{(1-\tau)}{(1-r_f)^T}\int_0^\infty X_2 dF_{X_2}$, that the equityholder bears i.e. $e(P_2) = K - D_2(P_2)$. The equityholder's trade off is then

$$P_2^* = \arg\max_{P_2}\{E(P_2) - e(P_2)\} = \arg\max_{P_2}\{E(P_2) - (K - D_2(P_2))\} \tag{19}$$

# 3 Implications and Results

This section presents the implications and results obtained from the model described in the last section. These implications and insights help to answer the questions posed in the introduction.

[14]Remember that assets are assumed to be traded at its unlevered after tax value.

They are also compared to anecdotal evidence to provide a link to what happens on the financial market.

To visualize this more clearly, I introduce some measurements of gains and losses that the equityholder of the bondholder may achieve or suffer as a result of the acquisition. The *debt value added/loss* (DVA), is the gain or loss in value that the incumbent bondholder achieves or suffers as a result of the acquisition. The *equity value added/loss* (EVA) is the net[15] gain or loss in value that the equityholder makes or suffers as a result of the acquisition. The *debt agency costs* (DAC) are the difference between the debt value added/loss after the acquisition under a value maximizing capital structure and the debt value added/loss after the acquisition under an equity maximizing capital structure. The *equity agency gains* (EAG) is the difference between the equity value added/loss under a value maximizing capital structure after the acquisition and the equity value added/loss under an equity maximizing capital structure after acquisition. The *welfare loss* (WL) is the difference between the over all value created/lost by the acquisition after an equity maximizing capital structure is implemented versus a case where a value maximizing capital structure is implemented.

As I mentioned earlier, there are only numerical solutions to the model, there is no closed form solution. It is therefore necessary to assign values to the parameters. Table 1 presents the parameters that will have the same value throughout the paper. The assets in this model have all the same expected present value and are traded in bits having a value of 100. The annual volatility of the incumbent asset 1 is fixed as well. The value assigned to this parameter is set according to the empirical analysis of Schaefer and Strebulaev (2008) to the average annual asset volatility of a $BBB$ rated company. The conversion ratio of the convertible bond is also fixed. As mentioned in footnote 12, the conversion ration should not be to high. But it should also not be too low because if $\lambda \to 0$, the conversion option is void and the convertible bond degenerates an unsecured junior bond. The value in table 1 is a good trade off between the two issues.

Table 2 presents values for parameter that are fixed unless they are the object of interest. The correlation is a value that is not extreme in one direction or the other direction. The bankruptcy costs are chosen according to the Leland (2007) paper. In that paper the value is selected to meet observed recovery rates. In other papers analysing capital structure issues numerically, similar values are used e.g. in Leland (1998) or a bit lower in Hennessy and Whited (2007). The tax rate is an average value for both, the United States and Switzerland. The same value is used in Leland (1998) and Leland (2007). Time to maturity is set to an average as well, in Leland

[15] *Net* gains or losses for the equityholder means gains/losses after accounting for the fresh capital that had to be injected.

(2007) it is mentioned that this is close to the estimated average corporate bond maturity. For that maturity a comprehensive range of iTraxx and CDX indices exists and they are relatively liquid.

## A. The risk perspective

### I) Unsecured straight bond

The functions of interest in this analysis are the functions that express a shift in one of the stakeholder's value, agency cost or welfare loss. With the earlier mentioned term perspective I refer to a mesh, drawn over an appropriate two dimensional grid. For instance figure 1 presents the risk perspective of the DVA under a value maximizing capital structure i.e. the DVA drawn over a grid of the annual volatility of the acquired assets ($\sigma_2$) and the correlation between the incumbent and the acquired assets ($\rho$). I offer a perspective on risk, bankruptcy costs, taxes. For the risk perspective of the unsecured straight bond, the results are collected in figure 1, using the model introduced in the last section.

Figure 1(a) and figure 1(b) present the DVA under a value and an equity maximizing post-acquisition capital structure. The north corner of the $\sigma_2/\rho$-plane is the point with lowest risk i.e. low volatility and no correlation, the south corner is the point with the most risk i.e. high volatility and almost perfect correlation. What is observed is the following: An increase in the company's asset volatility leads to a loss for the bondholders - having a concave claim - and to a gain for the equityholder - having a convex claim. This holds true under a value maximizing capital structure as well as under an equity maximizing capital structure. The models implies here classical asset substitution. The reverse holds true for the EVA presented in figure 1(c) and figure 1(d). Since the equityholder's claim is convex, the result is that the riskier the acquisition is, the more the equityholder gains.

What is also visible for both - the DVA and the EVA - the losses and gains respectively are more pronounced for the equity maximizing leverage choice. That can be seen more detailed in figures 1(e) and 1(f). DAC and EAG are both different from zero and the agency gains/loss increase with risk. The equityholder may extract agency gains from the bondholder, not only through asset substitution but also through a dilution of the bondholder's claim. He may do that by using the change in the company's capital structure triggered by the acquisition to accumulate excess leverage. This is presented in the special figure 1(h), which illustrates the difference in post acquisition leverage ratio of a value maximizing and an equity maximizing capital structure. The difference is positive and increasing with risk. It is classical debt dilution that the model is

implying here.

The agency gains are more pronounced the riskier the acquisition is, because then debt dilution may be reinforced with asset substitution. The order of magnitude of the dilution is between 2% and 4%. This is a bit more that what was implied by Leland (1998) for an unsecured straight bond. The question is, if that is a figure to worry about. In the much publicised *Marriot Case* of 1993, the incumbent bondholders lost - according to Parrino (1997) - about 4% of their value. As a consequence of the incumbent bondholder's pressure, the spin off plan was revised to reduce their loss. So the model seems to imply an order of magnitude that is relevant to investors, but still reasonable enough to find anecdotal evidence.

Another example to demonstrate how this problem of debt dilution is observed in practice: In 2001 the US company *Martin Marietta Materials* took over *the fellow US company Meridian Aggregates.* Martin Marietta was more focused on chemical building materials, while Meridian was an aggregates and cement company. So there is certainly some correlation between the two business, since both company's belong to the sector of building materials. This acquisition lead to an increase in asset volatility as well as to an increase in leverage which eventually lead to a decrease in interest coverage. As a result of that this led to a *weaken [of the] existing bondholder protection measures [namely the interest rate coverage]* [16] and to a downgrade of Martin Marietta's commercial paper program by Fitch. This is exactly what is implied by the model in this paper.

The welfare loss is very low as an absolute figure, but it is also increasing with the riskiness of the acquisition. This is because of the bondholder's convex claim, the claim is the more diluted, the risker the acquisition is and asset substitution by definition implies that the company's business risk is increased. The agency costs and thus the welfare loss is the worst, the more risky the acquisition is.

### II) Senior secured bond

The senior secured bond is a bond, where the bondholder's claim is senior to any potential new bondholder. What happened above with the unsecured straight bond was that it was diluted either by taking on more debt that was ranked pari passu (debt dilution) or by increasing the risk of the company's assets (asset substitution) or even both. But no matter what effect was responsible for the bondholder's agency loss, the reason why it happened was a dilution of the bondholder's claim. It is important to note that it is not the entire claim that was diluted, but

[16] Source: Article in Business Wire, Date: Thursday, March 8, 2001.

only the embedded claim on hypothetical liquidation proceeds. This is exactly where seniority clause becomes effective. Figure 2(a) illustrate this. The DVA of an incumbent bondholder with a senior claim is on the entire grid positive. This has two reasons: The incumbent bondholder is legally protected against direct debt dilution through the seniority clause. On top of that, there is no room for indirect dilution through asset substitution. The company is doing an acquisition, which means that it is expanding its asset base. So even if the incumbent assets are expanded with extremely risky assets, there are - in the event of a default, which is where the unsecured claim was vulnerable - still more assets to liquidate and thus in probabilities more liquidation proceeds to satisfied the senior claim. The only way to dilute the claim would be to siphon assets out of the company i.e. to reduce the asset base. This is sometimes called *asset dilution.* For a secured bond that would be a breach of contract - the assets to be spun off are pledge as a collateral - and it is assumed that this does not happen. But it is this what the bondholders were concerned about in the Marriot spin off of 1993. There the equityholders were about to reduce the asset base of the company and thus reducing the value of the incumbent bondholder. Empirical evidence in Maxwell and Rao (2003) affirms more generally, that spin-offs are potentially diluting for incumbent bondholders.

The shape of the DVA however, is similar to the one of an unsecured bond: The less risk, the more is there to gain for the incumbent senior bondholder. The explanations for that is that the senior bond's payoff is still - despite the seniority clause - concave and thus the bond's value is decreasing in risk. The more risky the assets are, the more likely is default and thus the value added of the incumbent bond must be decreasing in risk. The overall conclusion is therefore that a seniority clause protects the incumbent bondholder almost perfectly from agency costs caused by acquisitions, but it does not change the shape of the claim, it is still concave.

The equityholder faces a trade off that is altered compared with the unsecured bond since in this situation he may suffer and agency problem. This is presented in figure 2(b). The equityholder has still a claim which is increasing in risk and thus for most of the grid, the best acquisition for him is one that is very risky. But an additional effect is now more clearly visible. The equityholder has two ways in which he may increase the value of his claim through an acquisition: One is by relying on the convexity of his claim and thus increasing the risk - a positive[17] risk effect. The other is in reducing his share of the acquisition costs i.e. reducing the amount of capital he has to contribute to the acquisition - a capital effect. Why would the capital outlay matter? This capital effect is related to the debt overhang problem first noted in Myers (1977)

[17] Positive for the equityholder.

and is an agency problem as well: In the standard debt overhang problem, the face value of the incumbent debt is higher than the expected payoff of the assets and as a consequence of that, an additional investment by the equityholder would - at least in part - be absorbed by the incumbent bondholders. The debt is then called *underwater*. The bondholder's DVA in figure 2(a) is decreasing in risk i.e. the lower the risk the more the bondholder profits form the value added created by the acquisition. Thus he is profiting from the equityholder's capital outlay - without contributing to it. So in some sense the incumbent bondholder is the agency player here. In the most part of the grid in figure 2(b), the risk effect is dominating. Towards the west corner of figure 2(b), the capital effect starts to dominate and thus the EVA is decreasing instead of increasing in risk. This is because leverage is decreasing with risk and the best choice for the equityholder in that region is to lever the acquisition as much as possible and thus reducing the capital outlay. This may be surprising but it is perfectly rational. In the middle of the grid, neither effect plays and the company finds itself in a debt overhang problem. The capital effect influences an unsecured bond as well. However, with an unsecured bond debt dilution is more effective than the capital effect.[18]

There is some anecdotal evidence on that: In 2007, the Mexican cement company *Cemex* took over the Australian cement and building materials company *Rinker*. Although Rinker was from Australia, up to 80% of its sales were generated in North America. Cemex was already present in the North American market, Rinker's geographical presence was very different from Cemex's presence. At this point in time, the North American market was thought to be a low risk market for building materials. Moreover, the market has still strong regional difference i.e. the regions are not very correlated.[19] Overall the acquisition was not expected to increase risk. Inline with the implications of this model, the capital effect was dominating and the Rinker acquisition was essentially a buyout, mostly funded with debt.[20].

The reverse happened two years later: Holcim also announced in 2009 that it will take a substantial stake in the Chinese cement company Huaxin Cement[21]. Holcim was not really present then in China i.e. this was - particularly after the meltdown in the emerging markets construction sector in 2008 - a risky acquisition. This transaction was - in line with the insights that the model in this paper delivers - financed with a capital increase in Holcim.

[18] In figure 1(c) the capital effect is visible towards the west corner, in figure 1(d) the risk effect dominates so much, that the capital effect disappears.

[19] This still holds true within the United States. The effect on residential property price of the subprime meltdown was very heterogenous. While prices in California or Florida were heavily down, Texas property still generated very low positive returns.

[20] Source: Corporate Presentations of Cemex.

[21] Source: Company press release, June 15, 2009.

In terms of quantity, the bondholder's value shift that occurs as a result of the acquisition, is always positive. He may gain $1\% - 5\%$ on the acquisition. This is remarkable and may give room to capital structure arbitrage around mergers and acquisitions. The presence of a seniority clause reduces the gains for the equityholder. Which were with an unsecured bond at $1\% - 6\%$ with a value maximizing capital structure and $2\% - 9\%$ with an equity maximizing capital structure - to below $0\% - 2.5\%$ and leaves no room for agency gains through acquisitions. Since there is no room for agency, there is also no room for welfare loss.

### III) Callable bond

Textbooks like Brealey et al. (1981) and sales presentation often suggest that callable bonds are essentially issued because of two reasons: First, in order to give the issuer the option to refinance the bond if the reference interest rate significantly falls or second, to give the issuer the option to refinance the bond if the company's rating improves. Consequently, high yield bonds are often callable. The first motive is not relevant in this paper. In this model, credit spreads solely depend on the company's risk profile and on the company's leverage. The risk free rate is not stochastic. The second motive is not relevant as well, since it is only a two period model.
There is however a third, new rational for callable bonds: In a situation with an incumbent senior bond, the DVA was always positive i.e. the seniority clause forces the equityholder to share the value added of an acquisition with the incumbent bondholders. The equityholder leaves money on the table. This is the reason why a right to redeem the bond early may be valuable to the equityholder, even in the absence of the usual rationals for embedded options in corporate bonds. They allow the equityholder to refinance an incumbent bond with a new bond covering company's entire demand for external capital. This new bond can then be sold at fair value, instead of leaving money on the table for the incumbent bondholders. It allows the equityholder to have a *fresh start* and thus implement an exactly optimal capital structure. Since calling the bond implies that the entire capital structure is revised and a new, large bond is issued at fair value, there is no room for agency here. What is presented in figure 3(a) is only the EVA of an acquisition that has an optimal post acquisition capital structure with only one straight bond and equity. The other figures are irrelevant, since the incumbent bond is refinanced.
It may be surprising that the optimal acquisition would one be in the west corner of figure 3(a) i.e. with low risk. There are again the capital effect and the risk effect that enter the trade off here. The equity claim is still convex and even the assets on a company's books are in some sense a convex claim, since the company is protected by limited liability. For most of the grid

in figure 3(a), the capital effect is dominating. But as is also visible, at about $\sigma_2 = 0.3$ the slope of the EVA plane is reversed and - if the $\sigma_2$-axis would be widened - further east, in the region $\sigma_2 \in [0.4, 0.5]$ the EVA would surpass the EVA level in the west corner. The risk effect only starts to dominate this trade off at a high level of asset volatility and is the dominant value creator for an almost unrealistic level of asset volatility.[22]

Not only enables an embedded call option the equityholder to claim all the value added of an acquisition, it might even be a way of signalling that the company is sorting out hypothetical agency conflicts. Or it might also be a form of precaution against potential allegation that the company tries to extract agency rents. It is occasionally observed on the market that debt is refinance after an acquisition. When the Swiss duty-free shop operator Dufry took over the American Hudson Group in September 2008, it was expanding into a new region namely the United States and into the less concentrated duty-paid business. Although the acquisition was financed primarily with equity, the entire debt of Dufry and Hudson was replace by a new debt facility, and thus leaving no money on the table for the incumbent Dufry debt holders.[23]

### IV) CLO

A CLO is a bond that is secured with a specific asset, placed in a bankruptcy remote entity. A CLO has an advantage for both stakeholder: Since the assets are placed in separate entities, one entity is not influenced by the other and thus DVA is zero over the entire grid and is not plotted. The bondholder is therefore protected against every possible form of agency mentioned so far, debt dilution, asset dilution and asset substitution. So from the bondholder's perspective, this form of debt contract makes sense, when agency costs are a potential issue. As it was mentioned earlier, this is especially the case when risk is high.

The equityholder has an advantage as well: Since the acquisition is brought into a new entity, the equityholder may reduce that he potentially leaves money on the table. The EVA surface for the CLO is presented in figure 3(b). Because the acquisition is held by a subsidiary rather than the original company, the correlation $\rho$ with the incumbent assets does not influence the optimal capital structure of the subsidiary. The default risk is separated. As it is visible in figure 3(b), a CLO make sense for the equityholder, if risk is either very high or very low. On the low risk side, the equityholder may reduce the money left on the table. On the high risk side, the equityholder may reduce financing costs through a separation of the bankruptcy risk. He may also take advantage of additional limited liability as this was discussed in Leland (2007).

[22] This might to some extend be driven by the static structure of the model.

[23] Source: H1-08 analyst's presentation of Dufry.

The present form of debt contract was and is still common for companies in businesses which are capital intensive. Examples would be energy upstream, airlines or cement making. Also they were extensively used to refinance all kinds of mortgages.

Another example for the use of securitization would be the now bankrupt Enron. Enron made extensive use of securitization before its default. It financed its merchant assets to a large extend with debt through various subsidiaries. In 1999 Enron North America[24] pooled a group of loans to its merchant assets in the United States into a trust sold them as Collateralized Loan Obligations (CLO).[25] There is no information what kind of loans Enron pooled in that CLO, but Enron's new merchant assets were - compared with the original gas pipeline and gas wholesale business - fairly risky.[26] At the time the CLO was issued Enron was heavily acquiring risky assets. This CLO was therefore an ideal solution to avoid agency conflicts[27] in the future with the bondholders - on top of that - leaving no money on the table for bondholders to other project not included in the CLO.

### V) Convertible bond

In textbooks, convertible bonds are often praised as *sweetened debt* i.e. as an instrument to reduce credit spreads by letting the bondholder profit from the upside. This is undoubtedly one feature of convertible bonds, but as odd it may seem, in the base case of this model, i.e. prior to an acquisition, it is inefficient to issue a convertible bond. This is because exercising the conversion option destroys the tax shield. This has the consequence, that it pushes up the conversion bound.

The DVAs of the convertible bond are presented in figures 4(a) and 4(b) for a value maximizing capital structure as well as for an equity maximizing capital structure. The incumbent bondholder has now two parts that drive the value of his position. One is the embedded conversion option, whose payoff is convex in shape, the other is the bond part of the convertible bond whose payoff is concave in shape. The shape of the DVAs in figures 4(a) and 4(b) similar to a standard bond i.e. the bond part of the convertible bond is driving the bondholder's added value in shape. But by comparing figure 4(a) to figure 1(a), it can be noticed that the shape of the DVA surface is similar, the level of the convertible bonds DVA surface is however different. This is the influence

[24] A subsidiary of Enron, holding most merchant assets in the United States.

[25] Enron did a series of transaction with loans that were at least questionable if not illegal. This CLO transaction did - according to Powers et al. (2002) - NOT belong to this group.

[26] Jeffrey Skillings is heard saying *We like risk, because you make money by taking on risk.* in the movie *Enron, the smartest guys in the room* of 2005.

[27] Remember, most of Enron's story is about corporate governance or agency issues between Enron and its shareholders and not between Enron and its creditors.

of the conversion option,

The welfare loss, that is illustrated in figure 4(g), is with 1.8% to 2.5% remarkable in size. Conversion options are therefore not only vulnerable from the bondholders perspective, but may also be inconvenient for a potential social planner. Striking is the shape of the welfare loss surface. It is not the worse the more risk there is but the worst region is somewhere in the middle. The agency games are - not surprisingly - more efficient with increasing risk.

Looking at the DVA in figure 4(b) as well as at the DAC in figure 4(e) it is also clear, that the convertible bond is vulnerable to agency issues. A convertible bond is a hybrid financing instrument, an as mentioned earlier. I assume that the additional straight debt can be issued senior to the convertible bond. The first agency problem is equivalent to the one with the unsecured straight bond. The equityholder may engage in diluting the incumbent bondholder's claim by issuing straight debt. He can reinforce that with asset substitution i.e. by doing a risk acquisition. This is the first reason why the a convertible bond in this model is vulnerable to agency problem. The second agency problem is related to the conversion option and is again an agency problem that is related to the Myers (1977) the debt overhang problem: The equityholder has no incentive to put up additional capital for the company. Through the embedded conversion option, the incumbent bondholders would profit from a hypothetical investment that the equityholder helps to finance. A convertible bond is underwater when the conversion option dominates the value of the bond. This is problem is further worsen by presence of the anti dilution clause. The conversion option is written on non diluted equity whereas the equityholder holds diluted equity. The convertible bond suffers in a way a *constant debt overhang problem.* This underinvestment problem of the equityholder is illustrated in the special figures 4(h) and 4(i). They illustrate the surface of leverage ratios of the company after the acquisition for a value maximizing capital structure in figure 4(h) and for an equity maximizing capital structure in figure 4(i). The leverage ratio in figure 4(i) is across the entire surface higher than in figure 4(h). This reflects exactly the equityholder's lack of incentive to contribute additional capital to the company. The equityholder tries to neutralize the debt overhang problem with excess leverage. The potential agency losses that are illustrated in figure 4(e), are remarkably in size, namely between 8% and 18%. Investors in convertible bonds therefore have to monitor the company's financing and M&A activities closely.

The equityholder looses under a value maximizing capital structure on every acquisition on this grid as illustrated in figure 4(c). This is a direct consequence of the convertible bond's debt overhang problem mentioned in the last paragraph. Under an equity maximizing capital structure,

the equityholder may make rather large gains on acquisitions as illustrated in figure 4(d). About half of these gains are attributed to agency as illustrated in figure 4(f). All these surfaces are increasing in risk.

The market is well aware of the opportunities and problems that occur with convertible bonds in acquisitions. During the first half of 2009, the Australian uranium exploration company *Scimitar Resources* took over the fellow Australian metal and noble metal mining company *Jackson Minerals* to became *Cauldron Energy.* In the month where the acquisition took effect (June 2009), the company issued a new convertible bond to - among other things - redeem an existing convertible bond of Scimitar Resources.[28] The target is an exploration company, the acquisition can therefore be considered as a risky one.

In another example, Satcom Technology, a supplier of technology for alternative energy sources announced in 2007 that it will *accelerate its growth in the alternative energy market* which meant to mean to growth through acquisitions. At the same time they announced that they would raise new external capital under their existing promissory notes program to finance there growth and to retire an existing convertible bond.[29]

These two examples show that the market is well aware of the agency problems that can occur with incumbent convertible bonds. In both cases, the agency loss seemed to be sever enough that both companies could not afford to jeopardize their reputation as a debtor by not buying out the incumbent bondholder prior to the expansion.

Sometimes convertible bonds even have voting rights on fundamental change i.e. they have some bargaining power. In 2005 the London-based *Crew Gold* took over the fellow London-based *Guinor Gold.* Both companies are gold mining and gold exploration companies. The acquisition was financed with debt as well as equity and was subject to approval of both, the incumbent Crew Gold equityholders as well the incumbent holders of a Crew Gold convertible bond. The Crew Gold convertible bond was protected against additional borrowing.[30]

A company issuing a convertible bond, may signal with that, that it considers itself to be a mature company. In 2005 *Intel,* a former technology bubble highflyer issued a convertible bond. This was viewed by the market as a sign that the growth of Intel is coming to an end.

[28]Source: Company Presentation 2009 of Cauldron Energy.
[29]Source: Company press release, Nov. 9, 2007.
[30]Source: Company press release, November 21, 2005.

## B. The bankruptcy costs perspective

With the earlier definition of a perspective, the bankruptcy costs perspective is a mesh over a grid of average annual asset volatility ($\sigma_2$) - in a way the master parameter - and bankruptcy costs ($\alpha$). In some sense this is another risk perspective, since bankruptcy costs are hypothetical losses in default.

### I) Unsecured straight bond

For an unsecured straight bond, this is presented in figure 5. For a value maximizing capital structure after the acquisition, figures 5(a) and 5(c) illustrate what one would expect: The higher the bankruptcy costs the less added value is there to gain. For the incumbent bondholder, this is a direct consequence of a high loss given default when bankruptcy costs are high. For the equityholder the consequence is indirect: The equityholder receives nothing in default, but the higher the bankruptcy costs, the large are the financing costs. That is why the equityholder's EVA surface is similar in shape in the bankruptcy costs direction, but reversed in the asset volatility direction.

What is more interesting is the equity maximizing post acquisition capital structure. At first - by only looking at the EVA in figure 5(f) and the EAG in figure 5(d) - it looks fairly standard. The more risk and the less bankruptcy costs, the more is there to gain in value and agency for the equityholder. But what is not reflected in these previous figures, but becomes evident in figures 5(e), 5(g) and 5(h), is that the equityholder is actually doing a trade off between agency gains and costs of additional leverage. This is illustrated in the special figure 5(h), that plots the difference between the leverage ratio under a value maximizing capital structure and an equity maximizing capital structure. When the costs of bankruptcy are modest, then the costs of additional debt are modest and the equityholder may use this additional debt to dilute the incumbent debt claim. But with bankruptcy costs growing, the costs for the additional debt begins to raise and this limits the application of excess leverage for debt dilution. That is why the DAC surface in figure 5(e) has a kink in the middle. That's where the trade off starts to turn. Excess leverage becomes costly and only the costs of a smaller tranche of excess leverage are offset by agency gains. Since the excess leverage that is taken on for debt dilution is directly causing a welfare loss, the shape of the welfare loss surface in figure 5(g) shares the shape with the DAC surface. The EAG surface in figure 5(f) and the EVA surface 5(d) are however not affected by this kink, since the equityholder - for himself - does a smooth trade off between agency gains and costs of debt.

### II) Senior bond

The results for a senior bond are reported in figures 6(a) and 6(b). For the senior bond, the DVA is - as to expect - decreasing in the level of bankruptcy costs. What is rather surprising is the shape of the EVA surface, it is namely increasing in bankruptcy costs. The reason for that is again the debt overhang problem that the seniority clause bears. Since the equityholder's payoff is zero in default, assets with low bankruptcy costs only increase the value of the incumbent bondholders' claim through the seniority clause. The size of the debt overhang problem is decreasing in bankruptcy costs which is what leads to this unusual shape of the EVA surface and it is what makes the equityholder favor a regime with high bankruptcy costs.

### III) Callable bond and CLO

The results for a callable bond and a CLO are reported in figures 7(a) and 7(b). There is nothing unexpected to report for these two contracts. Both contracts allow for a new trade off - may it be through separate entities or a fresh start in the same entity - and thus they have an EVA surface that is decreasing in bankruptcy costs. Since bankruptcy costs directly drive costs of the new debt, the equityholder has an incentive to keep the bankruptcy costs as low as possible.

### IV) Convertible bond

The EVAs for a convertible bond are presented in figures 8(a) - 8(g). What may seem surprising is that - contrary to all the other bonds - under both, a value maximizing and an equity maximizing capital structure, the DVA surface is over most of the grid increasing in bankruptcy costs. The EVA however, is over most of the grid decreasing in bankruptcy costs. The latter was observed before, but not the former. The explanation for that is the hybrid structure of the convertible bond.

For the bondholder, the question is what part of the bond dominates. When bankruptcy costs are low, then the convertible bond is in the area of debt i.e. it is in a way a *busted convertible bond*[31]. This is because when bankruptcy is not very costly the acquisition is mainly financed with debt and then the conversion bound $X_{CV}$ - being an increasing function of additional debt - is high and thus the probability of conversion is low. The value of a busted convertible bond is equivalent to an unsecured bond. In figure 5(a), DVA in is in the region where the convertible bond is in the area of debt positive, but very low. Since the convertible bond is an unsecured bond and junior to potential new straight bond, a busted convertible bond is vulnerable to agency.

[31] A *busted* convertible bond, is a convertible bond where conversion is unlikely.

This is why under an equity maximizing capital structure, the claim is diluted with new straight debt. DVA for that situation in figure 8(b) is negative in the region where the convertible bond is in the area of debt. The same holds true for the DAC in figure 8(e), which is very negative in the region where the convertible bond is in the are of debt. Since the excess leverage from agency also leads to a welfare loss, the welfare loss in figure 8(g) is very pronounced in the region where the convertible bond is busted.

Equivalent to the situation with an unsecured straight bond, under an equity maximizing capital structure the equityholder is enabled to take advantage of debt agency in the region where the convertible bond is in the area of debt. That is reflected in figure 8(d) and figure 8(f). EVA as well as EAG are high in the region where the convertible bond is in the are of debt.

With increasing bankruptcy costs, the debt part of the convertible bond looses value and the conversion option becomes the dominant part of the convertible bond. The bond is then in the area of equity. In this region the equityholder faces the problem, namely the convertible bond's constant debt overhang problem. The equityholder has an incentive to increase leverage i.e. to keep his own capital contribution as low as possible. This is however no longer possible when bankruptcy costs are high because this also means that the costs of new debt are high. On top of that the success of classical debt agency is limited since the equityholder cannot compensate the high costs of debt with agency gains. The equityholder cannot compensate his underinvestment incentive with leverage, but he can also not compensate it with agency gains. As a consequence of that EVA in the region where the convertible bond is in the area of equity in figure 8(d) is negative. This implies that in this region, the equity cannot overcome the debt overhang problem and thus the equityholder is better off not doing the acquisition. The conversion option may therefore prevent positive NPV acquisitions with high bankruptcy costs.

The bondholder profits from that rather hypothetical situation. Debt agency looses its power, so DAC in figure 8(e) are almost zero in the region where the convertible bond is in the are of equity. The equityholder's (hypothetical) capital injection is mainly consumed by the incumbent bondholders in the region where the convertible bond is in the area of equity as illustrated in figure 8(b). Since there is not much room left for excess leverage to serve agency purposes, the welfare loss in figure 8(g) is also almost zero in the region where the convertible bond is in the are of equity.

### V) A note on the size of the value shifts

Since the questions in the intro do not only aim to make an assessment in terms of the direction of value added and value shifts but also in terms of the order of magnitude, some words about it for the bankruptcy perspective. Except for the convertible bond, EVA for realistic bankruptcy costs are between 2% and 5%. DVA is between $-4\%$ and 4%, depending if the overall value or the equity value was the basis of the capital structure trade off. For the convertible bond which include an embedded option, this option increases the range of the upsides as well as the range of the downside[32] and the figures run up to $-/+20\%$. Welfare loss is between 1% and 2%.
Looking at the numbers, the level bankruptcy costs has an impact on a relevant level on the size of value shifts during acquisition. There is an impact of remarkable level across all contracts. This especially for assets with high bankruptcy costs. So inline with Yagil (1989) - where this was confirmed empirically - bankruptcy costs are in important financial parameter that should be considered when assessing a potential acquisition.

## C. The tax perspective

With the earlier definition of a perspective, the tax perspective is a mesh over a grid of the master parameter average annual asset volatility ($\sigma_2$) and the tax rates ($\tau$). But it might be more accurate to call it a *leverage ratio perspective,* since the corporate tax rate has a direct effect on leverage.

### I) Unsecured straight bond

The results for an unsecured straight bond are presented in figure 9. As mentioned at the beginning, the tax rate has a direct impact on the company's ex ante leverage ratio. On the one hand, the higher the tax rat is, the more room is there for a tax shield and thus the higher is the leverage ratio. But on the other hand, the higher the leverage ratio, the less room is there to play games with excess leverage. Under both, a value maximizing capital structure and an equity maximizing capital structure, the bondholder favors a regime with a high tax rate for an acquisition - as presented in figures 9(a) and 9(b).
For the equityholder, the preferred tax regime depends on the risk of the acquisition. If the risk of the new assets is low, then for both, a value maximizing capital structure and an equity maximizing capital structure, the equityholder prefers a regime with a low tax rat as presented in figures 9(c) and 9(d). Otherwise too much of the leverage capacity has to be reserved for the tax

[32] Through the debt overhang problem.

shield. There remains little flexibility either to install a value maximizing capital structure or for agency. Also with a high incumbent leverage ratio, a high tax rate and low risk, the equityholder faces another debt overhang like problem. He has to contribute fairly much to the acquisition in terms of capital, since the company's capacity for additional leverage is low. The bondholder may then once more profit form that investment, since there is then more unlevered after tax asset value available. This can be observed in figure 9(h) which plots the difference between the pre-acquisition and the post acquisition leverage ratio for a value maximizing capital structure. When the acquisition is one with low risk and the tax rate is high, then there is a lot more room to increase the leverage ratio that there would be if the tax rate would be low. Since the equityholder cannot overcome this debt overhang problem, his EVA - as presented in figure 9(c) - is negative in the eastern corner and the acquisition is undesirable. The same problem holds true for an equity maximizing capital structure - presented in figure 9(d) - when risk is low and the tax rate is high.

When the risk of the acquired assets are high, the trade off is different. The equityholder's debt overhang problem becomes less important and asset substitution becomes more important. If the incumbent leverage ratio is high as a result of the high tax rate, then the equityholder can dilute the incumbent bondholder's claim by acquiring risky assets - classical asset substitution. That is illustrated in figures 9(c) and 9(d) in the north corner. This is less efficient when the tax rate is low. Then there is less leverage in place and thus less debt that can be diluted. And potential newly issued debt - which is expensive when the risk is high - has to be issued at fair value. Asset substitution - which is the agency issue here - is also what is driving the EAG in figure 9(f) - the surface is leaning towards the north corner.

Under an equity maximizing capital structure, the DVA in figure 9(b), the DAC in 9(e), the welfare loss in figure 9(g) as well as the difference in ex ante and ex post leverage ratio in figures 9(h) and 9(i) experience a reversion of the slope in the middle, similar to the one observed in the bankruptcy cost perspective in figure 5. The equityholder is trading off two effects here, namely benefits from claim dilution against costs of excess debt. When walking up that tax rate axis from zero, then the excess leverage increases - and with that the agency costs and the welfare loss. But then further up the grid, this is reversed. Then excess leverage becomes very costly and is reduced. This is why the peak of excess leverage and thus the bottom of welfare loss is somewhere in the interior.

### II) Senior bond, callable bond and CLO

For the senior bond, the DVA and the EVA surfaces are presented in figures 10(a) and 10(b). This trade off is with respect to acquisitions as one would expect: The bondholder favors a high tax rate, because then there is not much financial flexibility left and not a lot of room for agency. For the equityholder, the situation is exactly reversed. As it is presented in figure 10(b), for high tax rates the EVA is negative and thus the acquisition is not desirable for the equityholder. This is because of the debt overhang problem that the seniority clause bears and that is worsen by a high tax rate.

The EVA surface for a refinance callable bond presented in figure 11(a) is increasing in the tax rate. This might be surprising. The result is driven by the assumption that assets are traded at its unlevered after tax value. Then the higher the interest rate, the larger is the tax shield that the company can generate by leveraging the asset.

The EVA of the CLO is presented in figure 11(b). With the CLO, the acquisition is leveraged separately. Similar to the callable bond, the EVA is increasing in the tax rate, since the newly acquired assets are traded at it's unlevered after tax value.

### III) Convertible bond

The situation with the convertible bond is more complicated, since two payoff profiles are mixed. It was noted earlier, exercising the conversion option bears a loss in tax shield. In Stein (1992) convertible bonds were termed *backdoor equity financing.* The loss in tax shield is in some sense a negative consequences of that. The level of the tax rate influences the likeliness of conversion and thus the region in which the conversion option dominates the convertible bond's value. The loss in tax shield is increasing with the tax rate, conversion is therefore more likely when the tax rate is low. This is why DVA for both approaches to maximize the capital structure in figures 12(a) and 12(b), is high at the lower end of the tax rate axis. The option part of the bond dominates there.

The equityholder is again stuck with the constant debt overhang problem that the conversion option bears. The EVA surface in figure 12(c) and 12(d) is decreasing towards the lower end of the tax rate axis - the region were conversion is likely - which reflects the equityholders debt overhang problem. It is also illustrated in the special figure 12(h) which presents the company's ex post difference in leverage ratio between a value maximizing and an equity maximizing capital structure. The excess leverage in figure 12(h) is increasing towards the lower end of the tax rate axis, since the equityholder has an incentive to use debt instead of equity, since there is a wide

financial flexibility. This excess leverage is diluting to the incumbent bondholder's claim, but it is not the bond part that is affected - it is not dominating - but the option part of the convertible bond. This is because the excess leverage shrinks the value of the equity and thus lowers the value of the incumbent bondholder's hypothetical equity stake. It is a form of claim dilution. This is why - despite the high excess leverage - DAC in figure 12(e) are raising steeply towards the lower end of the tax rate axis, but the welfare loss in figure 12(g) is only moderately increasing. The agency gains of the equityholder in that situation on figure 12(f) are only moderate, since the equityholder is not trying to generate agency gains but is rather trying to avoid agency losses resulting from the debt overhang problem.

On the other end of the tax rate axis - the higher end - the situation is similar to the unsecured straight bond. In that area the bond part of the convertible bond is dominating its ex ante value - the convertible bond is busted. The equityholder is then again in the position to dilute the incumbent bondholder's claim, by taking on excess leverage and acquiring risky assets. The EVA in figures 12(c) and 12(d) as well as EAG in figure 12(f) are - as a result of asset substitution - higher when the acquired asset's annual volatility is high.

At the high end of the tax rate axis, there is a lot of tax shield to gain for the equityholder, since assets are assumed to be traded at its unlevered after tax value. But also at the high end of the tax rate axis, a lot of the company's leverage capacity is already used to create a tax shield. There is not much room for excess leverage to generate agency gains as illustrated in figure 12(h). The agency gains from excess leverage in figure 12(f) and the excess leverage itself in figure 12(h) are therefore not the highest at the high end of the tax rate axis, but somewhere in the middle, where the convertible bond slides from the area of equity to the area of debt. Or to put that in other words, the agency gains are the highest at the point where the dominating part of the convertible bond is switched from the option part to the bond part.

What is now interesting to see is that - despite the fact that agency through excess leverage is the most efficient in the middle of the grid - generating EVA by taking advantage of the tax shield is creating more value under an equity maximizing capital structure than taking advantage of agency. EVA in figure 12(d) is higher at the high end of the tax rate axis than in the middle, where agency is the most efficient. So if a convertible bond is the incumbent bond, a high tax rate tends to bust the incumbent convertible bond in the event of an acquisition. But it also offers some protection to the incumbent bondholder against agency, since under a high tax rate agency through excess leverage becomes unattractive.

**IV) A note on the size of the value shifts**

The size of the influence of a change in tax rate to the value shifts is in the range of 8% for bonds without options and up to 30% for realistic figures for a convertible bond. The reason for that difference is the potential destructive effect of conversion options on the tax shield. This seems high compared with Graham (2000), who estimated the tax benefit of debt to be between 4% and 10%. The model in this paper clearly overestimates the tax benefits to debt. This is because the model is a static model of capital structure which tend to overestimate leverage ratios and thus tax benefits of leverage. A dynamics model like Goldstein et al. (2001) would allow for more decent leverage ratios, but would also tremendously increase the complexity of analyzing structured debt contracts and acquisitions.

Are tax benefits/losses of acquisitions therefore of negligible size? Academic and anecdotal evidence suggests that the answer is no. Lewellen (1971) first suggested tax benefits as a reason for an acquisition. Brealey et al. (1981) however, list tax benefit from acquisitions under *dubious reasons for mergers.* But it seems that their categorization in *sensible* and *dubious* reasons for mergers would be largely equivalent to a categorization into *economic* and *financial* reasons for mergers. So Brealey et al. (1981) generally have doubt that there are financial reasons for an acquisition. The results in Leland (2007) as well as the results in this paper suggest that there are financial reasons for an acquisition.

Tax issues are an important part of every due diligence prior to an acquisitions. This is to some extend because of fiscal positions that occur as a result of the implementation of the merger e.g. legal restructuring or deferred taxes that must be realized.

# 4 What is a good contract...

This chapter aims at transferring the above analysis in recommendations for companies where unexpected acquisitions are potentially an issue. It is therefore set to answer 6 that was posed at the beginning.

## A. ...when risk is the main concern?

A simple unsecured straight bond is not a good choice. It is vulnerable to agency - especially when the risk is high. Although one would expect companies to avoid to generate agency gains - they want to keep a *clean* credit history - it is in an actually case difficult to determined if the gains that the shareholder make from the acquisition are a result of value added or of agency. If

both, the debt certificates and the shares are listed, the price movements and the movements in volatility may give a hint of what happens, but it is still difficult to tell. But even in the absence of agency, the equityholder favors risky acquisitions as a result of the convexity of his claim. The straight bond however is a concave claim and favors save acquisitions.

It has been discussed in the last section, how the situation changes when one of the following contractual features is added to the debt contract: A seniority clause, an early redemption clause, bankruptcy remoteness and an embedded conversion option. Unless the acquisition is negative i.e. it is a spin-off, a seniority clause offers almost perfect protection against debt dilution and asset substitution. It creates however a new agency problem that is similar to debt overhang. It is especially strong when the risk of the acquisition is somewhat similar to the assets in place. Then most of the added value of the acquisition is absorbed by the bondholders and the acquisition looses attractiveness for the equityholder.

An embedded call option offers a solution to this problem. It allows the equityholder to redeem the incumbent bond and refinance it with a bond issued at fair value. Within the scope of this model, an early redemption clause solves the debt overhang problem associated with the seniority clause. A similar argument is made in Childs et al. (2005), but with short term debt rather than with callable debt. Callable bond often include a penalty fee, so this option to restructure is - as opposed to the model in this paper - costly. But as recognized in Hennessy and Tserlukevich (2008), this penalty fee is tax deductible like interest, which brings the cost of the option to restructure down.

Securitization is a different solution to the two agency problems mentioned above. Leland (2007) argues that there are large benefits from securitization when the company backs the CLO with assets that are very save ($\sigma_2 = 0.04$) or that are very risky ($\sigma_2 = 0.5$). Figure 3(c) presents the difference in EVA between securitization and restructuring an incumbent callable bond. I use a bit different numbers, but I confirm that securitization is valuable for high risk assets. On the other end of the scale there is no advantage of securitizing a low risk acquisition but I do not go as deep down the scale as in Leland (2007).[33]

A convertible bond is rather messy when it comes to an acquisition. It is vulnerable to agency and the conversion option creates a debt overhang problem for risky acquisitions. Anecdotal evidence presented earlier, shows that convertible bonds are frequently refinanced around acquisitions sometimes the bondholders even have some of the bargaining power. Taking evidence from this

[33]The median annual asset volatility of a $AAA$-rated company is estimated at 0.21 by Schaefer and Strebulaev (2008). Although the value in Schaefer and Strebulaev (2008) might be overestimated, it is to doubt if there exist corporate assets that are as deep down the lower end of the volatility scale as in Leland (2007). In 2007, residential mortgage were thought to be at that low level - today the assessment would probably be different.

model, it makes sense to issue convertible bonds callable to avoid the potential problems around an acquisition. In Vanden (2009) an altered payoff structure for a convertible bond is proposed that - within his framework - solves the agency problems associated with a convertible bond around an acquisition. However, I think there is a legal and an economic problem associated with that payoff structure: I doubt whether an instrument with the payoff structure in Vanden (2009) would be classified as debt by the tax authority or the bankruptcy court, more likely it will be classified as hidden equity. Furthermore, the payoff structure is such that default occurs when asset values are high. This leads to high ex post bankruptcy costs and thus increases the cost of debt.

The overall recommendation from the evidence of the model in this paper would be to issue the incumbent debt callable and with a seniority clause. If the acquisition is very risky, then securitizing the acquisition makes sense. A convertible bond ought to be issued callable, to avoid potential problems around an acquisition.

## B. ...when bankruptcy costs are the main concern?

The issues for an unsecured straight bond are similar to the risk perspective but different in order of magnitude. Agency issues are the most pronounced somewhere in the middle of the grid at an average level and they are low for very high and very low bankruptcy costs. A regime with low bankruptcy costs is favorable for the equityholder. For this regime, there are almost no agency costs for the incumbent bondholder. For high bankruptcy costs agency is reduced, but does not entirely disappear.

A seniority clause reverses the equityholder's trade off: As a result of the debt overhang problem associated with that clause, the equityholder favors now a regime with high bankruptcy costs. This makes it problematic.

A call option preserves the shape of the EVA, the equityholder favors a regime with low bankruptcy costs. For securitization - the call option's rival - Gorton and Souleles (2007) put forward, that bankruptcy cost consideration are the most important motive for asset securitization and that companies with risky assets and high bankruptcy costs are likely to securitize assets. Figure 7(c) presents the difference in EVA between securitization and restructuring an incumbent callable bond. As opposed to Gorton and Souleles (2007) and similar to Leland (2007), this difference is low over the entire grid. The difference is the largest 1.5% when the assets have low bankruptcy costs and high risk.

If a convertible bond is the incumbent bond, then the situation is - from an agency perspective -

ambivalent: On the one hand, the bankruptcy costs influence the likelihood of actual conversion of a convertible bond. Everything being equal, the higher the bankruptcy costs, the more is the conversion option worth relative to the bond part of the convertible bond - the convertible bond is in the area of equity. So when bankruptcy costs are high, the equityholder's debt overhang problem is more sever and he has no incentive to pursue acquisitions. On the other hand, when bankruptcy costs are low, the bond part dominates the situation - the convertible bond is in the area of debt. The convertible bond is junior to any new debt and thus very vulnerable to agency. The bottom line for the convertible bond is, that it is vulnerable to agency around acquisitions and the level of bankruptcy costs determine which stakeholder suffers from the agency costs. Again a convertible bond should be issued callable.

The overall recommendation for a regime with low bankruptcy costs is unsecured straight debt or securitization. The first recommendation is because claim dilution through acquisitions is nearly impossible when bankruptcy costs are low. Also under unsecured straight debt, the equityholder actually favors a regime with low bankruptcy costs. This holds across the entire risk grid.

For assets with high risk, securitization is favorable. It makes the equityholder better off than callable debt, there is no claim dilution and no debt overhang and the seniority clause is potentially harmful for the bondholder. So it is certainly true for the specific case in Leland (2007) that bankruptcy costs consideration are not relevant in size. A more extensive analysis however, reveals that - inline with Gorton and Souleles (2007) - bankruptcy cost indeed drive the application of securitization. In a way both papers are right, Leland (2007) for the specific case analyzed in section IV.B while Gorton and Souleles (2007) is right in terms of quality and for a broader consideration.

## C. ...when taxes are the main concern?

Taxes help to protect the holder of an unsecured straight bond from agency. This is because with high taxes, much of the leverage capacity of the company has to be used for a tax shield and there remains little flexibility for excess leverage for agency.

For the same reason, high taxes worsen the debt overhang problem that the equityholder faces with a seniority clause.

Both, callable debt and securitization favor a high tax rate, since it increases the tax shield generate with the acquisition. In figure 7(c), the difference between the EVA after an acquisition involving a redeemed callable bond and one involving securitization. The tradeoff between callable debt and securitization depends more on risk than it does in the tax rate. Generally, a

higher tax rate tends to favor callable debt.
The convertible bond is again vulnerable to agency through claim dilution and debt overhang. It ought to be issued callable.
When the tax rate is low, unsecured debt is vulnerable to agency. The debt overhang associated to a seniority clause is low and thus a call clause is almost neutral. A callable senior bond is therefore to favor when taxes are low.
When taxes are high, claim dilution is less of a problem but an unsecure straight bond is still vulnerable to asset substitution. If the risk of the acquisition is not too high, unsecured straight debt can be appropriate. If it is not, again callable senior debt is to favor.

# 5 Conclusion

This paper contributes to the literature of capital structure by analyzing the impact of an unexpected corporate acquisition on a set of different incumbent structured debt contracts. Unsecured debt, senior debt, callable debt, securitization and conversion options were analysed in this paper.
Unsecured debt is vulnerable to claim dilution and asset substitution. By taking on excess leverage the equityholder can transfer value from the unsecured straight bond to his own claim. High risk favors agency costs, while high bankruptcy costs - through high costs of leverage - and a high tax rate - through the fact that most of the company's debt capacity has to be allocated to the tax shield - offer some protection from debt agency. But especially the second protection immediately opens another agency problem, namely one that is similar to debt overhang. The bondholder is potentially free riding on acquisitions that the equityholder is financing.
A seniority clause protects the bondholder form debt agency. But it allows the bondholder again to free ride on the acquisition. With an incumbent bond that has a seniority clause, the equityholder leaves value added on the table that is absorbed by the bondholder. This problem is especially pronounced when risk and bankruptcy costs are low.
An new motive was proposed to issue callable bonds. An early redemption clause offers the equityholder the option to restructure the incumbent debt. The equityholder can refinance a bond that would otherwise forces him to leave money on the table. A seniority clause combined with a call option is often a good choice for a company where unexpected acquisition might be an issue. The seniority clause protects the bondholders from agency and the call option makes sure that there will be no money left on the table.

Securitization is a structuring tool that applies bankruptcy remoteness. This offers protection from agency as well against both, claim dilution and debt overhang. It also helps to reduce the financing costs of very high risk acquisition by separating the bankruptcy risk and taking advantage of limited liability.

Incumbent convertible bonds are problematic with acquisitions. When the bond is in the area of debt it is vulnerable to claim dilution, when it is in the area of equity, the equityholder suffers a constant debt overhang problem. It makes sense to issue convertible bonds callable and anecdotal evidence suggest that convertible bonds are refinance around acquisitions.

In terms of order of magnitude, the value added and the value transfers between the claimholders are of perceivable size, but mostly within single digit percentages. Anecdotal as well as academic evidence suggests that this is a level that is relevant to the investors implying that careful structuring of debt contracts has not only implications in quality but also in quantity. The welfare loss from agency is similar to Mauer and Sarkar (2005): not very pronounced and seldom about 1%. It is associated with excess leverage to dilute debt claims.

Finally the question was to answer what a good contract is for companies with potential acquisitions. A callable senior bond offers protection to both forms of the agency problem by adding protection to the bondholder and flexibility to the equityholder. For high risk acquisition it can be worth while to explore the advantages of bankruptcy remoteness. If risk is low then there is no need for structuring and simple unsecured straight debt is applicable. Convertible bonds are problematic around acquisitions and should be redeemed.

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# Appendix A: Standard parameter values

| Fixed Parameters | | |
|---|---|---|
| Description | Parameter | Value |
| Expected present value of asset 1 | $X_1^0$ | 100 |
| Expected present value of asset 2 | $X_2^0$ | 100 |
| Annual volatility of asset 1 | $\sigma_1$ | 0.22 |
| Conversion ratio of a convertible bond | $\lambda$ | 0.25 |

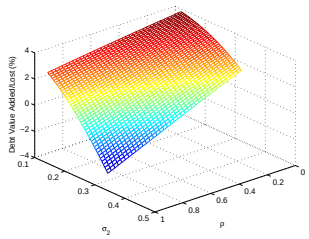
Table 1: Values for parameters that are fixed.

| Fixed Parameters, unless they are part of the examples | | |
|---|---|---|
| Description | Parameter | Value |
| Correlation between asset 1 and asset 2 | $\rho_{1,2}$ | 0.5 |
| Bankruptcy costs | $\alpha$ | 0.23 |
| Corporate tax rate | $\tau$ | 0.2 |
| Time to maturity | $T$ | 5 years |

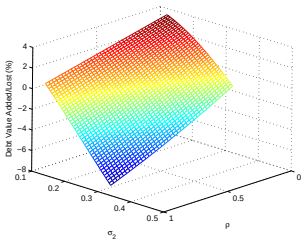
Table 2: Values for parameters that are fixed unless mentioned otherwise.

# Appendix B: Illustrations on the risk perspective

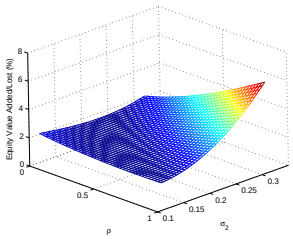
## A. Unsecured straight bond



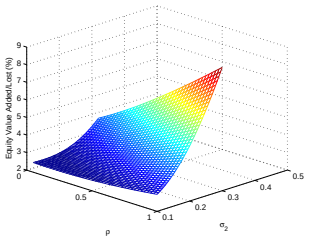

(a) Debt value added, value maximizing capital structure



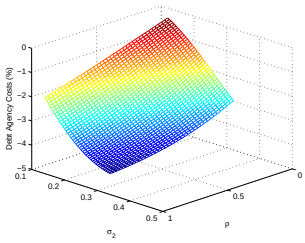

(b) Debt value added, equity maximizing capital structure



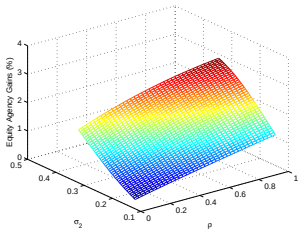

(c) Equity value added, value maximizing capital structure



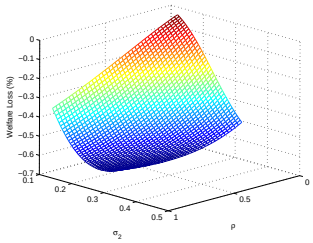

(d) Equity value added, equity maximizing capital structure



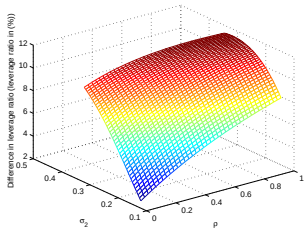

(e) Debt agency costs




(f) Equity agency gains



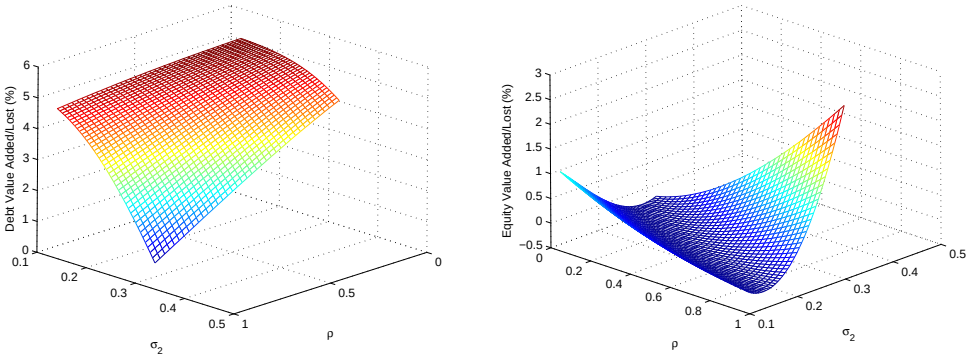

(g) Welfare loss




(h) Excess leverage of an equity maximizing capital structure

Figure 1: The value added/loss for the stakeholder, the agency gains/losses, the welfare loss and the excess leverage of an agency maximizing capital structure of an acquisition for an *unsecured straight bond* over a $\sigma_2/\rho$-plane.

## B. Senior secured bond

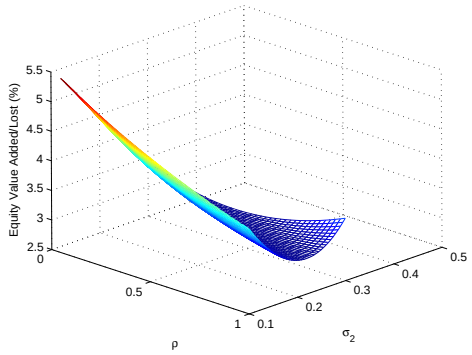



(a) Debt value added

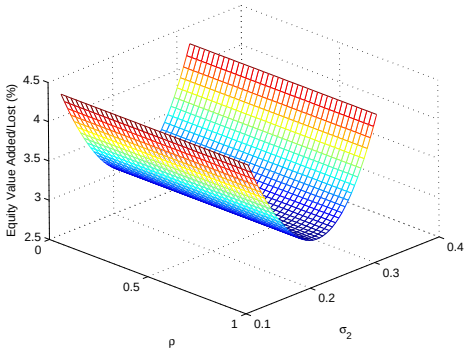
(b) Equity value added

Figure 2: The value added/loss for the stakeholder of an acquisition for a *senior secured bond* over a $\sigma_2/\rho$-plane. The value maximizing and the equity maximizing capital coincide in this case.

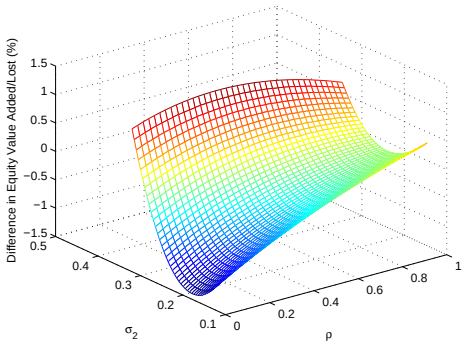
## C. Callable bond and CLO




(a) Equity value added, callable bond that has been refinanced



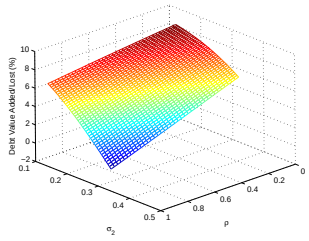

(b) Equity value added, CLO



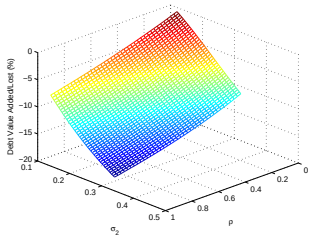

(c) Difference in Equity value added between a CLO and a refinanced callable bond

Figure 3: The equity value added/loss of an acquisition for a *callable bond* that has been refinanced and a *CLO* over a $\sigma_2/\rho$-plane. The value maximizing and the equity maximizing capital coincide in this case.

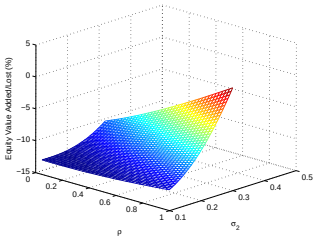
## D. Convertible Bond



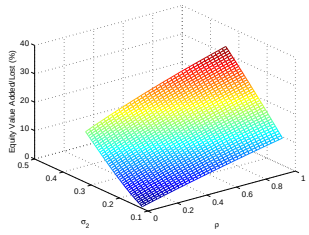

(a) Debt value added, value maximizing capital structure



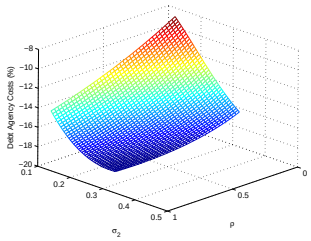

(b) Debt value added, equity maximizing capital structure



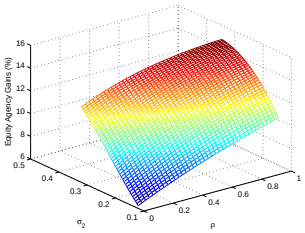

(c) Equity value added, value maximizing capital structure



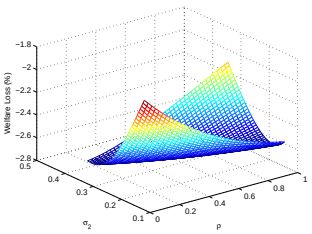

(d) Equity value added, equity maximizing capital structure



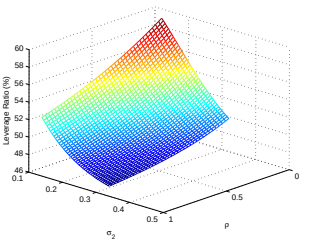

(e) Debt agency costs



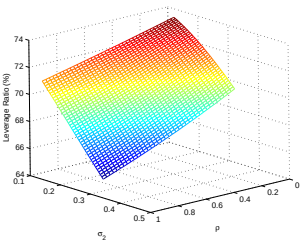

(f) Equity agency gains




(g) Welfare loss




(h) Post acquisition leverage ratio, value maximizing capital structure

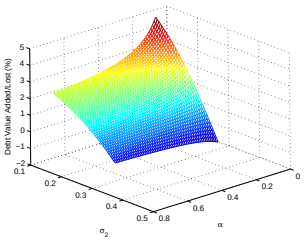



(i) Post acquisition leverage ratio, equity maximizing capital structure

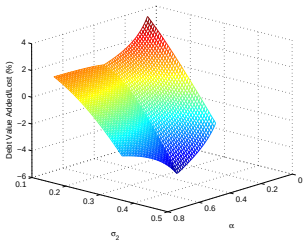
Figure 4: The value added/loss, the agency gains/losses, the welfare loss and the post acquisition leverage ratios of an acquisition for a *convertible bond* over a $\sigma_2/\rho$-plane.

# Appendix C: Illustrations on the bankruptcy costs perspective

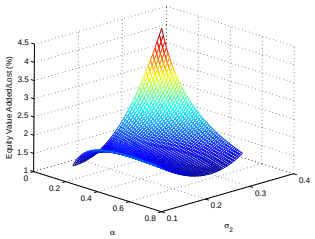
## A. Unsecured straight bond



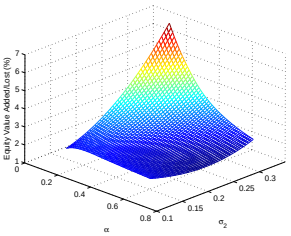
(a) Debt value added, value maximizing capital structure



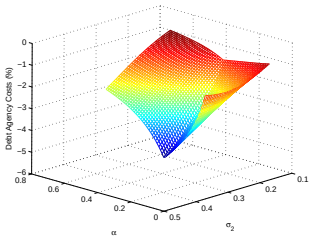
(b) Debt value added, equity maximizing capital structure



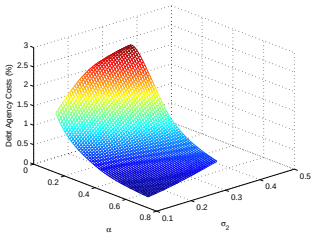
(c) Equity value added, value maximizing capital structure



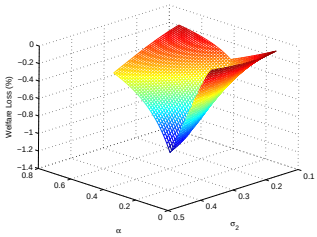
(d) Equity value added, equity maximizing capital structure



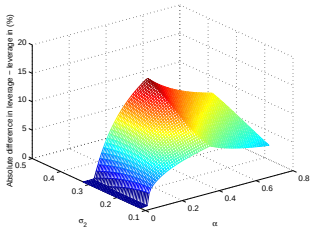
(e) Debt agency costs



(f) Equity agency gains



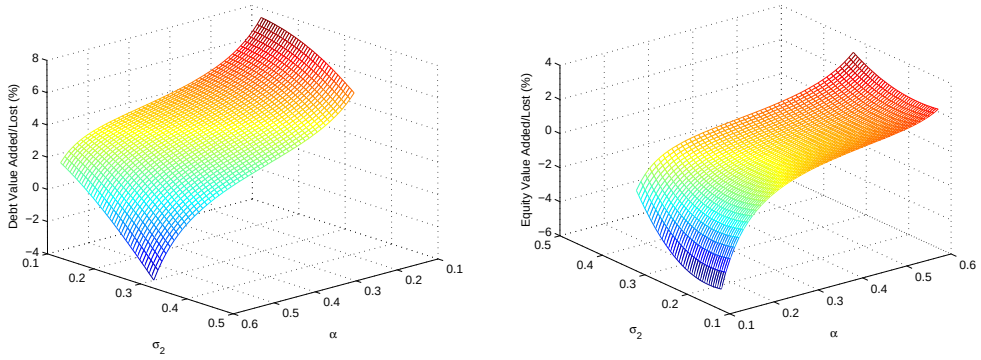
(g) Welfare loss



(h) Excess leverage of an equity maximizing capital structure

Figure 5: The value added/loss for the stakeholder, the agency gains/losses, the welfare loss and the excess leverage of an agency maximizing capital structure of an acquisition for an *unsecured straight bond* over a $\alpha/\sigma_2$-plane.

## B. Senior secured bond

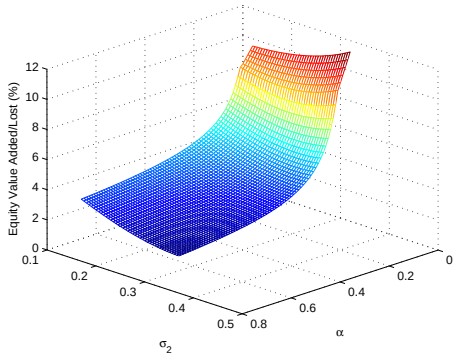



(a) Debt value added

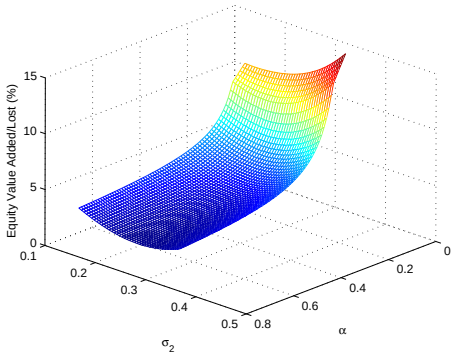
(b) Equity value added

Figure 6: The value added/loss for the stakeholder of an acquisition for a *senior secured bond* over a $\alpha/\sigma_2$-plane. The value maximizing and the equity maximizing capital coincide in this case.

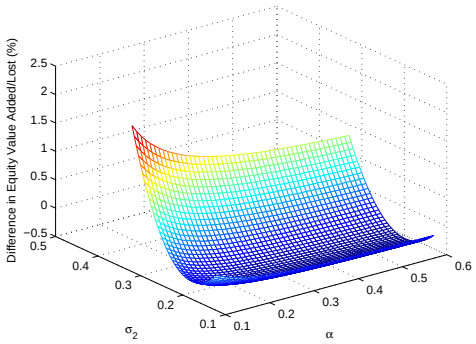
## C. Callable bond and CLO




(a) Equity value added, callable bond that has been refinanced



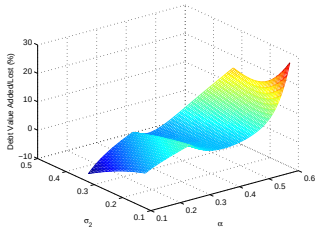

(b) Equity value added, CLO



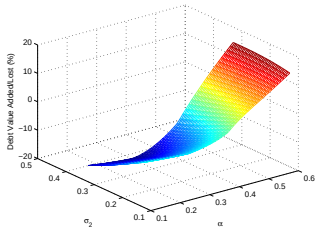

(c) Difference in Equity value added between a CLO and a refinanced callable bond

Figure 7: The equity value added/loss of an acquisition for a *callable bond* that has been refinanced and a *CLO* over a $\alpha/\sigma_2$-plane. The value maximizing and the equity maximizing capital coincide in this case.

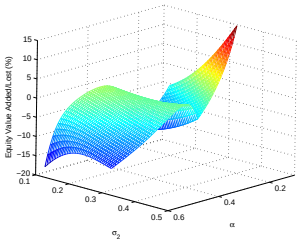
## D. Convertible Bond



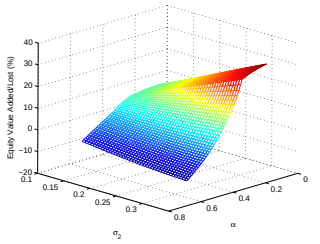

(a) Debt value added, value maximizing capital structure



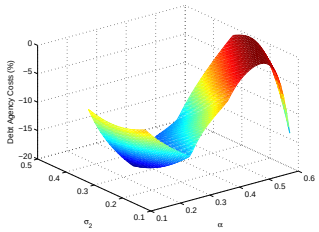

(b) Debt value added, equity maximizing capital structure



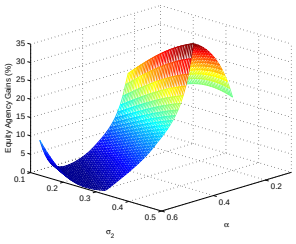

(c) Equity value added, value maximizing capital structure



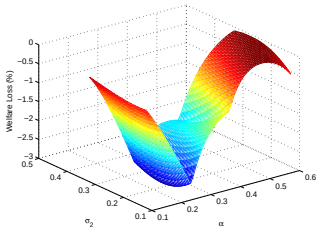

(d) Equity value added, equity maximizing capital structure




(e) Debt agency costs




(f) Equity agency gains

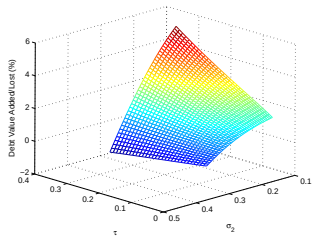



(g) Welfare loss

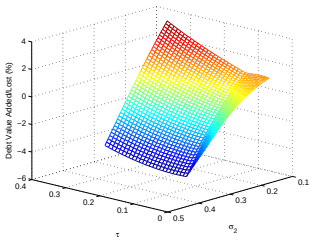
Figure 8: The value added/loss, the agency gains/losses and the welfare loss of an acquisition for a *convertible bond* over a $\alpha/\sigma_2$-plane.

# Appendix D: Illustrations on the tax Perspective

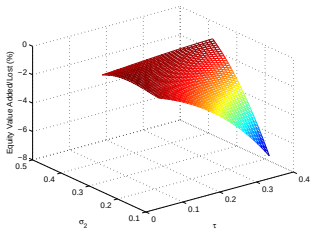
## A. Unsecured straight bond



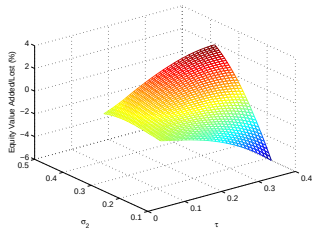
(a) Debt value added, value maximizing capital structure



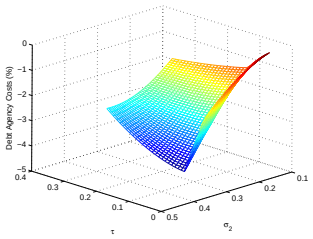
(b) Debt value added, equity maximizing capital structure



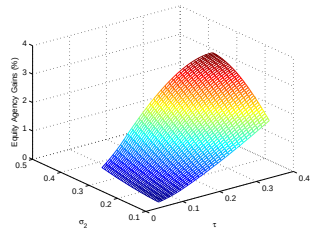
(c) Equity value added, value maximizing capital structure



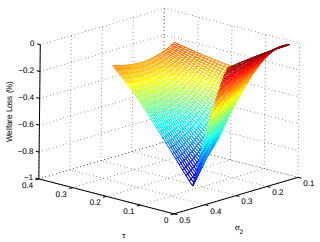
(d) Equity value added, equity maximizing capital structure



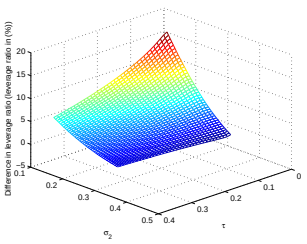
(e) Debt agency costs



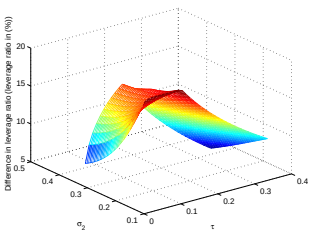
(f) Equity agency gains



(g) Welfare loss



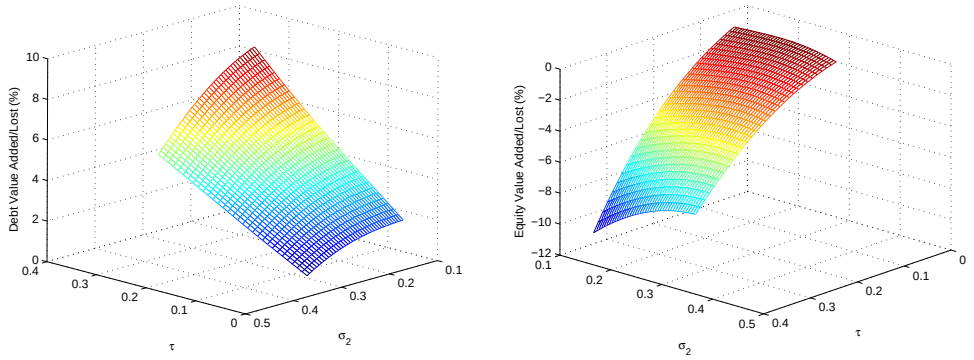
(h) Difference in leverage ratio before and after the acquisition, value maximizing capital structure



(i) Difference in leverage ratio before and after the acquisition, equity maximizing capital structure

Figure 9: The value added/loss for the stakeholder, the agency gains/losses, the welfare loss and the difference in leverage of an acquisition for an *unsecured straight bond* over a $\tau/\sigma_2$-plane.

## B. Senior secured bond

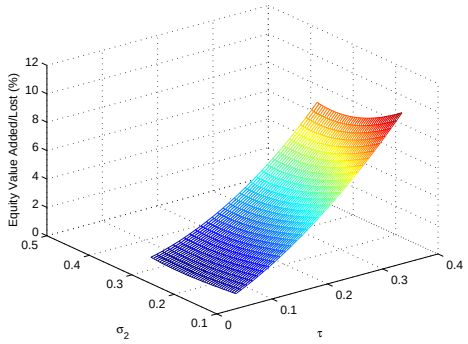



(a) Debt value added

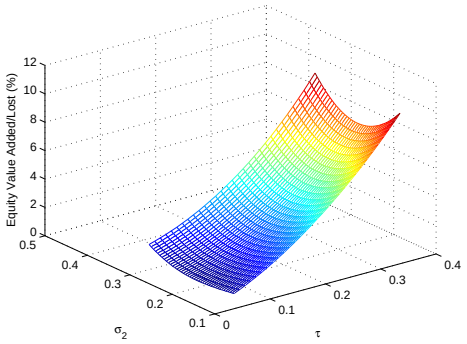
(b) Equity value added

Figure 10: The value added/loss for the stakeholder of an acquisition for a *senior secured bond* over a $\tau/\sigma_2$-plane. The value maximizing and the equity maximizing capital coincide in this case.

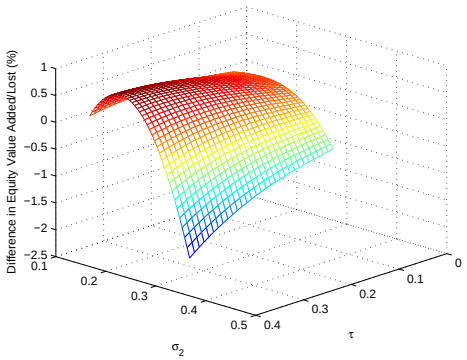
## C. Callable bond and CLO




(a) Equity value added, callable bond that has been refinanced



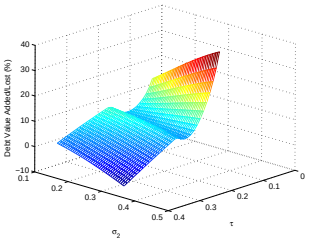

(b) Equity value added, CLO



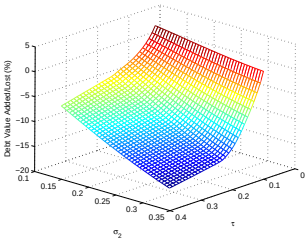

(c) Difference in Equity value added between a CLO and a refinanced callable bond

Figure 11: The equity value added/loss of an acquisition for a *callable bond* that has been refinanced and a *CLO* over a $\tau/\sigma_2$-plane. The value maximizing and the equity maximizing capital coincide in this case.

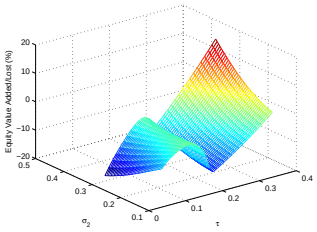
## D. Convertible Bond



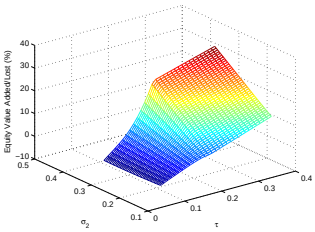

(a) Debt value added, value maximizing capital structure



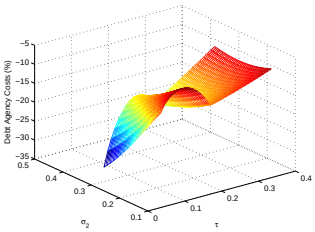

(b) Debt value added, equity maximizing capital structure



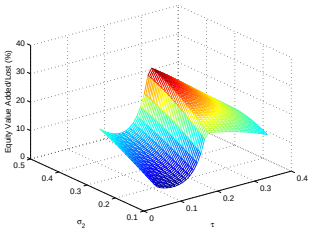

(c) Equity value added, value maximizing capital structure



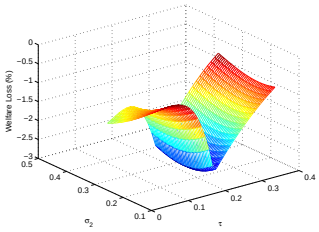

(d) Equity value added, equity maximizing capital structure



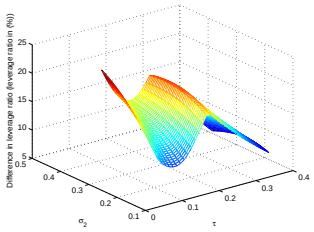

(e) Debt agency costs




(f) Equity agency gains




(g) Welfare loss




(h) Excess leverage of an equity maximizing capital structure

Figure 12: The value added/loss for the stakeholder, the agency gains/losses, the welfare loss and the excess leverage of an agency maximizing capital structure of an acquisition for an *convertible bond* over a $\tau/\sigma_2$-plane.

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